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A SUMMARY OF THE
IGUANID GENUS *UROSAURUS*

By M. B. MITTLEMAN

WITH SIXTEEN PLATES

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To

My wife, Mary Elizabeth, to express in a small measure my appreciation of her help and unflagging encouragement.

No. 2. — *A Summary of the Iguanid Genus UROSAURUS*

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INTRODUCTION

Among the several peculiarly North American genera of lizards, there remain but few which have not been subjected to an exhaustive monographic treatment. These have chiefly been small groups containing but relatively few species. One of the notable exceptions is the highly ramose genus *Urosaurus* Hallowell, 1854, which in itself is not to be found in current usage.

The present study had its genesis in the summer months of 1938, when I was afforded the opportunity to observe and collect numbers of specimens of the genus *Urosaurus*, in my capacity as herpetologist to the 1938 Rainbow Bridge - Monument Valley Expedition, under the able leadership of Dr. Angus M. Woodbury. The original effort to settle the contentious status of the species native to the Navajo country of northeastern Arizona and southeastern Utah, led to this study.

Many persons have contributed in a very real sense towards the fulfillment of the plan of investigation, and to all of these, grateful and sincere acknowledgment is made. In this connection, particular mention must be made of Dr. Herschel Thomas Gier, of Ohio University, to whom I am indebted for constant interest, support, and many fruitful suggestions. Drs. Leonhard Stejneger, Doris M. Cochran, and Alexander Wetmore, of the United States National Museum, have kindly made the great resources of that institution constantly available to me, and have offered much in the way of help and encouragement. Dr. Thomas Barbour must surely be accorded a more than ordinary word of grateful thanks for his generous help in the publication of this paper, as well as for the loan of very many specimens. Benjamin Shreve and Arthur Loveridge, of the Museum of Comparative Zoölogy; the late Dr. G. Kingsley Noble and Charles M. Bogert, of the American Museum of Natural History; M. Graham Netting, of the Carnegie Museum; Joseph R. Slevin, of the California Academy of Sciences; Dr. Laurence M. Klauber, of the San Diego Society of Natural History; Drs. E. Raymond Hall, Alden H. Miller, and Jean M. Linsdale, of the Museum of Vertebrate Zoölogy; Drs. Henry Fowler and Emmett Reid Dunn, of the Philadelphia Academy of Sciences; Dr. John Hack, of the Peabody Museum; Dr. Angus M. Woodbury, of the University of Utah; Dr. George F. Knowlton, of Brigham Young University; Dr. Karl P. Schmidt and Clifford Pope, of the Field Museum of Natural History; Dr. Howard K. Gloyd, of the Chicago Academy of Sciences; Dr. Raymond B. Cowles, of the University of California at

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PART I. THE TAXONOMY AND RELATIONSHIPS OF *UROSAURUS* AND ITS ALLIES

In 1852, Baird and Girard erected the genus *Uta* for a rather small lizard, prominently characterized by gular folds, auricular openings, and a fine, homogeneous dorsal scalation. Somewhat later in the same year these authors described another new form (1852:126), presumably also referable to the same genus, which was named *Uta ornata*. However, this latter form differed in several respects from the first-named form (*stansburiana*); most noticeable difference being the dorsal scalation, which consisted of rather fine scales everywhere, save along the median line, where they were abruptly enlarged, rather strongly keeled, and prominently imbricate; these enlarged scales were divided into two parallel series on either side of the median line by a series of somewhat smaller, vertebral scales. In 1854, Hallowell encountered another new form, generally similar to Baird and Girard's *Uta ornata*, save that the enlarged dorsals extended the length of the dorsum in a broad, uninterrupted band, lacking the presence of the smaller, dividing series of scales. On the basis of this scalation, Hallowell set up the genus *Urosaurus*. A somewhat similar move was next made by Duméril, who described the genus *Phymatolepis* (1856:548) for a Mexican lizard generally similar to the *Uta ornata*, but possessed of only a single series of enlarged dorsals on either side of the smaller vertebrals. The attempts of Hallowell and Duméril were shortlived, however, for in 1858 Baird described the species *Uta symmetrica*, a close ally of his previously named *Uta ornata*, and in the next year (1859:7) definitely placed Hallowell's *Urosaurus* in the synonymy of *Uta*. And in this synonymous category *Urosaurus* has remained, save for a brief use

as a subgeneric appellation by Van Denburgh (1922:182). Duméril's *Phymatolepis* has fared only slightly better, for Cope soon placed it in synonymy (1864:177), although on at least two occasions thereafter the name was used (Fischer, 1882:232; Boulenger, 1883:342), but was soon relegated to the oblivion of synonymy (Boulenger, 1885:214, 216), where it has since remained.

In addition to these attempts at generic restrictions, one other one was made in the long history of *Uta*. In 1863, Cope described the very distinctive *Uta thalassina*, a rather large iguanid differing in several respects from any previously known members of the then-recognized genus *Uta*. The general habitus of this lizard was sufficiently different from other known forms, so that Boulenger (1885:205) considered it generically distinct, and proposed the generic name *Petrosaurus*. Boulenger's attempt was promptly ignored by Cope (1887:35), who retained *thalassina* in *Uta* as originally described. Van Denburgh has used *Petrosaurus* subgenerically (1922:181), but other than this usage, the name has been considered a trite synonym of *Uta*.

A brief description of *Uta* (*auct.*) follows:

Size small to quite large; auricular openings present; dorsal scalation homogeneous, either keeled or smooth, or else with an abruptly enlarged series of scales along the median line; dorsal scales imbricate or pavemented; caudals greatly enlarged, spinose, heavily keeled, or else very minute, smooth, barely imbricate; ventrals rounded and smooth, or submucronate to mucronate, and keeled; gular fold heavily denticulate, or else with an even margin of small scales; supraoculars in one, two, or three principal rows; postfemoral dermal pocket present, or postfemoral dermal pocket absent; posterior maxillary teeth tricuspid; a sternal fontanelle present; xiphisternal abdominal ribs present; ventrum with or without blue patches in males; a bright blue postaxillary blotch present or absent; dorsal pattern either of short, broken cross bars extending from neck to sacrum, or else with three or four heavy black bars on the anterior portion of back; a distinctive dark neck or shoulder band present or absent.

Accepting such a loose definition of *Uta* makes necessary the inclusion of approximately thirty-seven species and subspecies exhibiting enormous gaps in structure, pattern, size, and distribution. It is exceedingly difficult to conceive of such a heterogeneous assemblage as having arisen from a single, even greatly generalized, primitive ancestor. Even the extremely diverse and multitudinous genus *Sceloporus* does not present as vicarious a group as is now recognized under the single all-encompassing heading of *Uta*.

With quite some comfort, I point out the following statement, "... genera are groups for convenience, ... no two people are ever likely to agree for long on generic limitations ... any means of breaking up large genera by setting off particularly well differentiated species or groups of species is justifiable..." (Stejneger and Barbour, 1933:vi.) I cannot reconcile myself to the thought that the many forms included in *Uta* are congeneric, and therefore recognize a division of these many forms; a redefinition of *Uta*, revival of *Urosaurus* and *Petrosaurus*, and the erection of a fourth genus, seems to adequately and more logically categorize these animals.

Genus *UTA* Baird and Girard

1852 *Uta* Baird and Girard, Stansbury's Expl. Surv. Vall. Great Salt Lake, p. 345.¹

Genotype. *stansburiana*.

Diagnosis. Small iguanid lizards (maximum size, snout to vent, approximately 75 mm.); prominently denticulated auricular openings and gular folds; dorsal scalation homogeneous, consisting of small, lightly keeled, rounded, imbricate scales; ventrals rounded, smooth, imbricate; caudals greatly enlarged, heavily keeled and spinose, strongly imbricate; supraoculars in one principal series; interparietal (occipital, *auct.*) large; postfemoral dermal pocket present; superciliaries imbricate; labials segmental; no distinctive blue abdominal patches in males; postaxillary and/or preaxillary dark blotches present; dorsal pattern consisting of small, pale maculations, or else principally of larger blotches in parallel series which may or may not be joined to form longitudinal bands; xiphisternal abdominal ribs present; a sternal fontanelle present; posterior maxillary teeth tricuspid.

Distribution. North America, from Texas to Washington and south to the southern portion of Baja California; the islands bordering California and Baja California in the Pacific Ocean and Gulf of California; northern Mexico, as far south as southern Sonora.

Remarks. As defined here, *Uta* includes *stansburiana* and its subspecies, as well as the species *taylori*, *concinna*, *mannophorus*, *martinensis*, *nolascensis*, *palmeri*, *squamata*, and *stellata*.

Concerning the question as to whether this name was published as cited here, or in the Proc. Acad. Nat. Sci. Phila., 1852, 6:69, Dr. Stejneger advises me, "Stansbury's Explorations has the priority of publication. It was 'published early in 1852, probably late March or early April.' The paper in the Proc. Phila. Acad. was read on April 27, consequently published considerably later." Contrary-minded are referred to Taylor, 1935:411, *et seq.*

Genus UROSAURUS¹ Hallowell

1854 *Uro-saurus* Hallowell, Proc. Acad. Nat. Sci. Phila., 7: 92.

Genotype. *graciosus*.

Diagnosis. Similar in many respects to *Uta*, but differing principally as follows: dorsal scalation not homogeneous, but consisting of minute scales except in the vertebral region, where the scales become abruptly enlarged, usually strongly carinate and imbricate, occasionally spinose; enlarged dorsal scales either separated into two parallel series by a median line of smaller scales, or else extending in a broad band for the length of the dorsum; ventrals often mucronate and keeled, especially laterally; postfemoral dermal pocket variable, regularly present in some forms, variable occasionally, absent in others; males with distinctive blue abdominal patches; no post- or preaxillary blotches; dorsal pattern of short, lateral bars, usually broken on the mid-line, occasionally a pattern aberration of longitudinal stripes; never wholly maculated above with small, light flecks.

Distribution. Texas west to California, and north to Utah; south throughout Baja California; Mexico along the west coast principally, as far south as Chiapas; islands bordering Baja California in the Pacific and Gulf of California; the Revillagigedo Archipelago.

Remarks. As defined here, *Urosaurus* includes the species and subspecies known heretofore as *Uta ornata* and its subspecies, as well as the numerous forms recently treated by myself (1941); also the species *microscutatus* and *nigricaudus*. See pages following for a fuller discussion of the forms of *Urosaurus*.

Genus PETROSAURUS Boulenger

1885 *Petrosaurus* Boulenger, Cat. Liz. Brit. Mus., 2: 205.

Genotype. *Uta thalassina* Cope, Proc. Acad. Nat. Sci. Phila., 1863: 104.

Diagnosis. Large iguanid lizards (maximum size, snout to vent, approximating 175 mm. or more); dorsal scalation homogeneous, consisting of small, smooth scales, which are usually pavemented; venter with slightly larger, smooth, pavemented scales; caudals small, weakly keeled, barely imbricate, smaller than ventrals; supraoculars in three

¹ I have followed the example of the Check-List in dropping the hyphen; cf. *Dipsosaurus*.

principal series; gular fold barely or not at all denticulate; supraoculars smooth (rather than rugose), as are the other cephalic scales; post-femoral dermal pockets present; venter lacking distinctive abdominal blotches in males; no pre- or postaxillary blotches; shoulders with three or four heavy transverse blackish bars.

Distribution. The southern portions of Baja California, and a few of the adjacent islands in the Gulf of California.

Remarks. As defined here, *Petrosaurus* includes besides the type species, the form which should properly be known as *Petrosaurus repens* Van Denburgh.

STREPTOSAURUS¹, gen. nov.

Genotype. *Uta mearnsi* Stejneger, Proc. U. S. Nat. Mus., 1894: 17, 589.

Diagnosis. Medium-sized iguanid lizards (approximating 100 mm., snout to vent), closely related to *Petrosaurus*, and bearing a superficial resemblance to *Uta* also, but distinguished from these two genera as follows: Differs from *Petrosaurus* in the smaller ventrals; the enlarged, strongly keeled, spinose caudals; the presence of two supraocular rows; the lack of a well developed anterior gular fold; the smaller size; the well developed lateral dermal fold; greater number of femoral pores; much larger preauricular spines; the absence of a bold pattern of three or four transverse bars in the scapular region; the presence of a distinctive neck band which is dark, and bordered behind with a lighter hue; the presence of a fairly heavy blue abdominal wash (approximating somewhat the blotches found in *Urosaurus*); and the prominent dorsal peppering of light flecks. Differs from *Uta* in the much smaller smooth and pavemented dorsal and ventral scales; the possession of two principal series of supraoculars; the lack of an anterior gular fold; the lack of denticulation on the gular fold; greater number of femoral pores; cephalic scales smooth, rather than rugose; the presence of a strong neck band of blackish; the absence of any small blotches dispersed in parallel series, or fused to form longitudinal bands; the presence of several well-marked dark cross-bands dorsally; the prominent caudal pattern of dark and light rings.

Distribution. Extreme southern California and the adjacent portion

¹ *Streptosaurus* = στρεπτος (wreathed, banded, or twisted) + σαυρα (lizard), in reference to the prominent neck band, or wreath, of this genus.

of Baja California; Angel de la Guardia and Mejia islands, in the Gulf of California.

Remarks. As defined here, *Streptosaurus* includes besides the type species, the form which should be properly known as *Streptosaurus slevini* Van Denburgh.

It is my belief that not only is the genus *Uta* (s.l.) divisible as given in the preceding paragraphs, but that two of the genera, *Petrosaurus* and *Streptosaurus*, are more closely allied to the section of the *Iguanidae* characterized by the genus *Crotaphytus*, than to *Uta* and *Urosaurus*, which are obvious derivatives of the *Sceloporus* stock. I base this assumption on several premises. First, *Uta* and *Urosaurus* are conceivably derivable only from *Sceloporus*, or perhaps some sceloporid form now extinct. Secondly, these two genera are very close to *Sceloporus* in their general habitus, and differ in only a very few points. On the other hand, we find that the general body form and details of structure characteristic of *Petrosaurus* and *Streptosaurus* are most nearly duplicated in *Crotaphytus*, of living genera. The genera *Crotaphytus* and *Petrosaurus* are in fact almost identical on superficial examination; however, they differ in the greatly reduced interparietal of *Crotaphytus*, as well as the very small and numerous supraoculars, and the other reduced and multiplied cephalic scales; they are further distinguished by the presence of palatines in the former genus, and the absence of these in *Petrosaurus*. Sternal fontanelles are apparently variable in *Crotaphytus* (*fide* Cope, 1900:247), but constantly present in *Petrosaurus*. Of the two genera, *Crotaphytus* is probably older in view of its more widespread distribution, and the closer similarity in osteology of this genus with that of primitive groups such as *Dipsosaurus* and *Ctenosaura*. *Streptosaurus* is most closely allied to *Petrosaurus* of living genera, and in the main probably best characterized as a fairly recent derivate. Properly speaking, neither the *Crotaphytus-Petrosaurus-Streptosaurus* stock, nor the *Uta-Urosaurus-Sceloporus* stock can be particularly considered as being either older or more primitive than the other. An accompanying diagram illustrates the probable derivations and positions of these genera amongst North American *Iguanidae*. It will be noticed that I have included several other genera in addition to those discussed above, for the sake of completeness. *Dipsosaurus* is probably the most primitive of the North American *Iguanidae* (excepting *Ctenosaura*, which is properly a Central and South American form), and possesses several points in common with *Ctenosaura*, most easily observed of which is the dorsal crest; the genera further show their relationship in the similarity of the cephalic scutel-

lation which is essentially simple, and shows no particular degree of differentiation. *Sauromalus* is considered a specialized offshoot of the *Crotaphytus*, or more properly, pre-*Crotaphytus* stock, by reason of its solid sternum, as well as the five-lobed teeth; the simple type of cephalic scalation indicates its affinity with the more primitive *Dipsosaurus*-

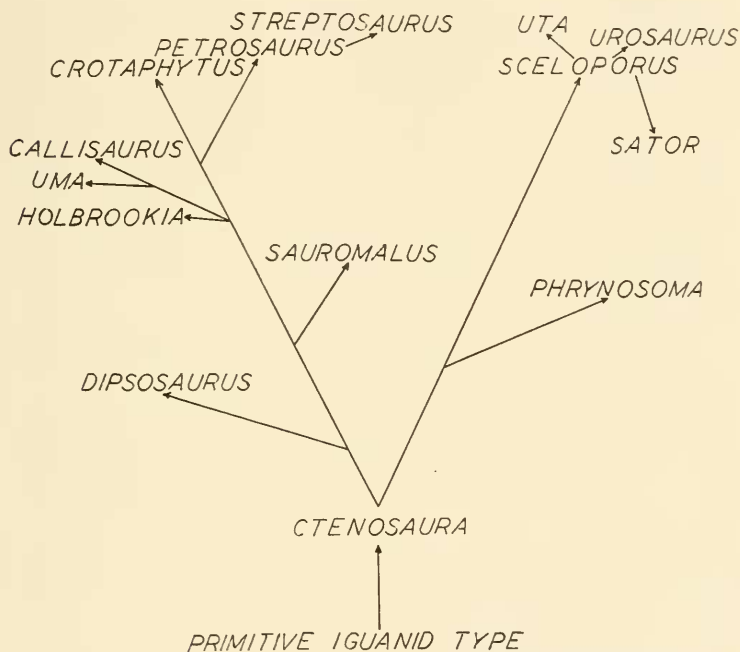


Fig. 1. The phylogeny and relationships of North American iguanid genera.

Ctenosaura stock. The three genera *Uma*, *Callisaurus* and *Holbrookia* form a compact group, presumably derived within comparatively recent times from a *Crotaphytus*-like stock. They resemble each other in the common type of dorsal scalation, and the imbricate superciliaries and supralabials. *Uma* is easily distinguished by reason of the enlarged digital fringes which *Callisaurus* lacks; *Holbrookia* does not possess auricular openings, which are present in the other two genera.

The other branch of the North American *Iguanidae* presents first *Phrynosoma*, a primitive but highly specialized genus, at once distinguishable by the squat and flattened habitus, as well as enormously developed cephalic scalation. Since the relationships of *Uta*, *Urosaurus* and *Sceloporus*, and that of this latter genus and *Sator*, have not been satisfactorily presented previously, I give a brief résumé based on available information.

In 1935, Smith discussed at some lengths the relationships of *Sceloporus* and *Uta* (s.l.), and concluded that the two genera, as then understood, were most nearly allied by *Sceloporus couchii* and *Uta* (= *Urosaurus*) *levis*. Smith later emended this somewhat, and postulated the belief that *Uta* "arose from the forms now extinct which closed the present gap between *couchii* and *merriami*." Shortly thereafter I subscribed to this point of view (1941), and presented further observations on the phylogeny of the Mexican *Urosaurus*. Since that time, further investigation of *Uta*, *Urosaurus*, and *Sceloporus* shows that these premises are only partly true.

Uta is considered as very nearly allied to *Urosaurus*, as indicated by the available evidence. Both genera apparently have sprung from an early progenitor which soon diversified sufficiently to produce the bifurcate branches we recognize today as *Uta* and *Urosaurus*. The latter genus is possibly the older of the two, or at least differentiated and spread more rapidly, judging by its more widespread distribution in the outlying Pacific Islands and southern Mexico. It appears that *Uta* probably did not become dispersed or diversified specifically until the beginning of the Miocene, for it is largely restricted to the continental portions of the United States and Mexico, and the adjoining islands, while being absent from some of the older Gulf and Pacific islands which had appeared prior to this time.

The closest relationship between *Uta* and *Urosaurus* occurs between *Uta squamata* and *Urosaurus microscutatus*. In these forms, the genera have apparently produced parallel lines, for *squamata* possesses the largest dorsals in *Uta*, and is fairly large, whereas *microscutatus* is one of the smallest of its genus, and possesses the least development of the dorsals.

As I have pointed out, while *Uta* and *Urosaurus* have doubtless shared a common ancestor if the evolutionary lines be carried back sufficiently, this ancestral type probably differentiated at an early date. Thus, as Smith points out, "in *couchii* . . . dorsal scales are extremely small for the genus, the laterals are minute, and the size of the species itself is small." In addition to these premises which serve to link *Uta*

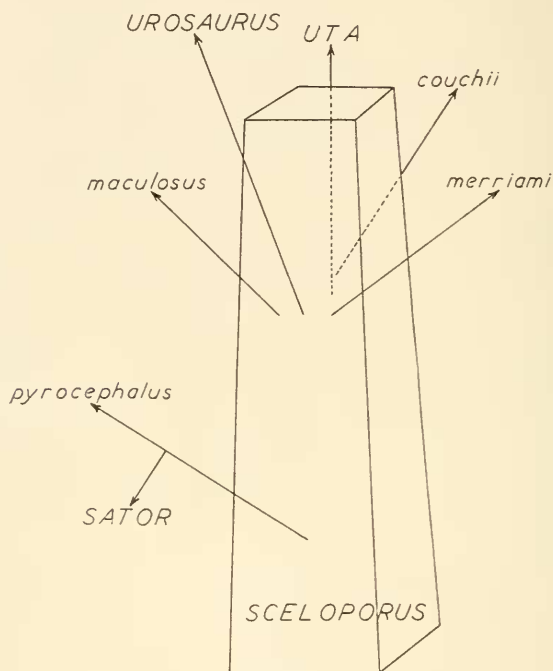
and *Sceloporus*, it may be said that *stejnegeri*, most primitive of the *Uta*s, and *couchii*, occupy overlapping areas. I would agree with Smith (1939:239) that *Uta* (through the medium of *stejnegeri*) is closer to *couchii* than to any existing *Sceloporus*; however, the derivation has probably taken place through the medium of a pre-*couchii* form, rather than through this latter species. Whether such a form would close the gap between *couchii* and *merriami*, in *Sceloporus*, I cannot say.

Urosaurus apparently most closely approaches *Sceloporus* through the *maculosus* and *merriami* groups of this latter genus, being not particularly closer to one or the other of these groups, but occupying a somewhat intermediate position. Somewhat as in the case of *Uta*, the origin of *Urosaurus* appears to have stemmed from an early precursorial stock which gave rise to the two groups of *Sceloporus*, as well as *Urosaurus*. In the *merriami* and *maculosus* groups are found small *Scelopori*, with larger dorsals than in *couchii* (and hence more similar to *Urosaurus*), more rugose dorsals than in *couchii*; in addition, the frontals are usually divided transversely, and rarely if ever longitudinally as in *couchii*; postfemoral dermal pockets present in *maculosus*, absent in *merriami* (variable in *Urosaurus*), constant in *couchii* (and also *Uta*). It will be seen therefore that *Uta* and *Urosaurus* may be considered as very nearly biological equivalents, for they are widely distributed, highly prolific, of about the same age, successful (as adjudged by the multiplicity of individuals and species), and derived from closely related progenitors.

The genus *Sator* Dickerson, 1919, is in some respects unique, and because of its relationship with *Sceloporus*, of interest here. Although Dickerson (*op. cit.*) mentioned certain osteological differences supposed to obtain in *Sator*, I have not been able to ascertain any constant osteological variations within the genera *Sator*, *Sceloporus*, *Uta*, and *Urosaurus*. Insofar as I am able to determine, distinguishing features of *Sator* are those of lepidosis and form. Thus, this genus may be recognized by virtue of its vertically compressed body and tail, rudimentary gular folds, poorly differentiated dorsal scales, and the rudimentary postanals in the males. Although some authors have considered *Sator* intermediate between *Uta* and *Urosaurus*, or between the former genus and *Sceloporus*, I am of the opinion that it is actually a direct derivative of the primitive *pyrocephalus* group of *Sceloporus*, and is not closely related to any other known lizards.

The *pyrocephalus* complex includes *pyrocephalus*, *gadoriae*, and *nelsoni*, all three of which exhibit compressed tails to some degree, at least in the males. Further, in these species, the dorsals are reduced;

in one, *gadoviae*, a postfemoral dermal pocket is present (as it is in *Sator*); a high femoral pore count exists; there is only a very gradual transition from the larger dorsals to the smaller laterals; and finally,



(lower case letters denote
species or groups of spe-
cies--capitals denote genera)
--modified after Smith, 1939--

Fig. 2. The derivation and intergeneric relationships of *Urosaurus* and allied iguanid genera.

the postanals of the males are either greatly reduced, or absent. *Sator* closely resembles these lizards in all the characters noted. Finally, *Sator* possesses dark lateral cross-bars on the male abdomen, a pattern

which is reproduced in *S. pyrocephalus*, and in no other known Sceloporid. Dickerson (op. cit.) postulated a close relationship between *Sator* and *Sceloporus utiformis* because of the rudimentary gular fold in this latter species, as well as certain other minor details. I have discussed this point with Dr. H. M. Smith, and we agree that on the whole, the derivation of *Sator* through the medium of the *pyrocephalus* group, seems much more likely. It is probably worthy of note to add that the formation of *Sator* has seemingly been of the most fortuitous nature, and almost certainly due primarily to insular isolation. This fact is borne out by the remarkable ability of the stock which produced *Sator*, to again emulate the same trend, even in a mainland population of *Sceloporus*, where in the relatively isolated *gadoviae* there exists a remarkable parallelism in color, pattern, ecology, and even scutellation to some degree.

PART II. SUMMARY OF THE GENUS *UROSAURUS*

Methodology and Scope of the Study

Approximately 6,500 specimens have been critically examined in the course of investigation of this problem. While ample numbers of some forms have been available, others are but poorly represented in collections. Specimens have often been haphazardly collected when and where opportunities permitted; necessarily therefore, many critical regions are not represented in available series, or else but scantily. The dynamic aspect of the study is thus heightened in view of the many problems which still present themselves. As Dr. E. H. Taylor so aptly termed Mexico, in relation to his study of *Eumeces*, it is the *terra incognita*, and insofar as *Urosaurus* is concerned, it is to this general region that future workers must turn for the answers to many questions.

I have not attempted to present all of the available data on the natural history of the numerous forms in the genus, but rather has the effort been restricted to the taxonomy involved, ecology being for the most part utilized only where it serves to explain problems of isolation, speciation, and kindred matters. It will be observed that each form is treated principally from the viewpoints of taxonomy, structure, and distribution. In essence therefore, this report resolves itself into a collection of taxonomic and other data of practical interest to the laboratory worker principally. Thus, long and detailed synonymies have

been omitted, and only those references which I have considered important to the proper understanding of the form in question have been given.

Herpetological taxonomy has seen several excellent uses of statistics in the study of genera and other natural associations, especially where large numbers of specimens have been available. In view of the multitude of specimens extant for this study, it was at first thought that these would lend themselves admirably to the statistical approach. Unfortunately, extensive measurements, scale counts, and the application of numerous formulae have not borne out this hope. True, mensural limits of variation and proportion have been ascertained for most of the forms, but qualitative data reduced to quantitative terms have proved all but useless. This is chiefly due to the fact that the distinguishing features of most forms are of a qualitative, rather than quantitative nature. Throughout this study, insofar as available specimens permit, populations have been examined, and populational trends have been given the most consideration, with relatively little or no emphasis on the individual. This has been necessitated by extremes in metachrosis, as well as an inordinate variation in individuals, particularly in minor details of scalation.

Throughout its range, *Urosaurus* exhibits a remarkable propensity for the proliferation of local trends, perhaps even unique genic strains. For the most part, these have been the result of the extreme ecological limitation of *Urosaurus*, which will only under the greatest duress leave its vertical habitat of rocks, trees, cliffs, and fences, and traverse the desert floor to a similar, nearby habitat. As a result of this ecological isolation of many populations, genetic involutions attributable to forced inbreeding are the mode, and result in many minor strains which characterize these small groups. The problem then, for the taxonomist, is to decide which of these trends is clearly definable, which population possesses these features to a distinguishing degree, and whether apparent morphological distinction is correlated with definite geographic and/or ecological niches. For the most part, these local trends are negligible other than for their academic interest. But in a few cases, closely related forms are separated (and apparently restricted) by only a scant dozen miles or so of desert floor. Quite possibly because of this marked propensity for isolation and the proliferation of superficial details, authors in the past who have dealt with this genus and have had only small numbers of specimens, or else specimens from widely separated localities, have in despair considered several distinct species synonymous with each other, and thus obscured the true relationships

of several forms, as well as making practical identification a matter of clairvoyance in many instances.

Certain details of structure and proportion have been found to be of prime significance, and are utilized throughout this report in the definitions and diagnoses of the species and subspecies. These are listed and annotated below:

Enlarged dorsal scales (fig. 3). These constitute the most readily observable, and in most instances important feature in nearly every

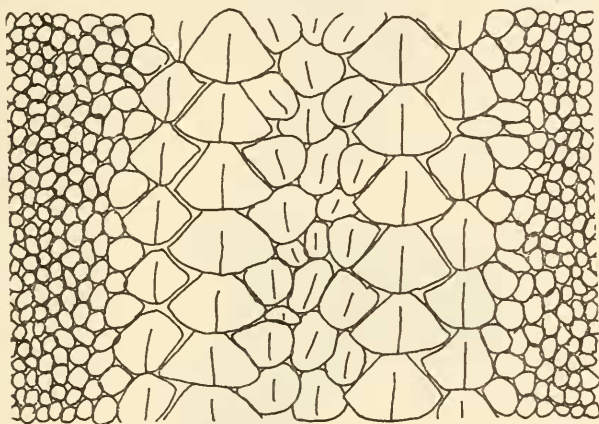


Fig. 3. Details of vertebral, primary, and secondary enlarged scales.

form. Enlarged dorsal scales are of two general types: vertebrals and the larger bordering scales. Thus, in several forms the smaller series of vertebrals extends from the nape to the basal portion of the tail, bordered on either side with a varying degree of constancy, by one or more series of larger scales. In numerous instances, the vertebrals are lacking, so that the enlarged scales are present as a more or less homogeneous band, with the largest scales on the midline, and the remainder progressively decreasing as they extend laterally. When the vertebrals are present the first parallel bordering series of enlarged dorsals is referred to as the "primary series"; if others are present too, they are termed "secondary series". Particular attention is given to the distribution and shape of the enlarged dorsal scales, as, whether

they are evenly dispersed, whether the individual scales are rounded posteriorly, or mucronate, submucronate, spinose, smooth, or carinated. Unless used to the contrary, the term "enlarged dorsals" refers specifically to the series bordering the smaller vertebrals.

Ventral scales. Reference is made in several cases to the structure and dispersal of these, generally in the same terms as those used for the enlarged dorsals.

Dermal folds. These are present in most forms, absent in a few. When present, they usually extend from the cervical region to the groin or further, and are usually on the dorsolateral or lateral line, or both. Since these are sometimes of diagnostic importance, especial attention should be paid to determine whether apparent dermal folds are actually true folds, or simply superficial wrinkles due to preservation.

Postfemoral dermal pocket (fig. 4). This is a slight dermal invagination within the angle formed by the posterior part of the femur and the

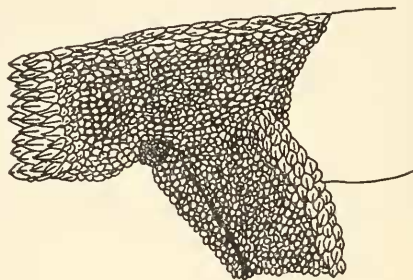


Fig. 4. Location and form of postfemoral dermal pocket.

body. It is lined with scales which are much smaller than those elsewhere on the body. The presence or absence of this structure is used diagnostically, and although variable in some forms, is usually highly constant. When the term "rudimentary" is employed to describe the pocket, it infers that it is represented by a small whorl of scales in a minor depression.

Tubercles. Tuberculation is for the most part referred to in comparative terms, but in a few instances the absence or presence of these modified scales on certain portions of the body is of diagnostic value.

Femoral and tibial enlarged scales (fig. 5). On the anterodorsal surface of the thigh, and in a band of varying width around the tibia, are

dispersed greatly enlarged, heavily keeled, and usually strongly spinose scales. The comparative size of these is often referred to. They are regularly present, save in one species.

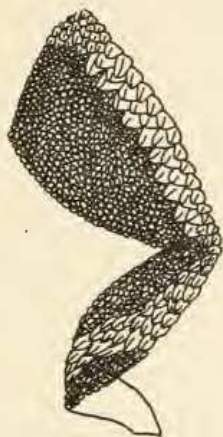


Fig. 5. Enlarged femoral and tibial scales.

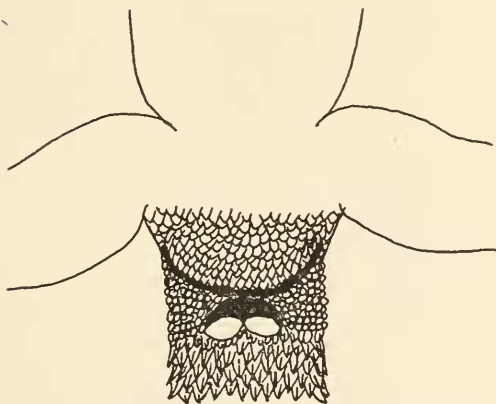


Fig. 6. Enlarged postanal scales of the male.

Enlarged postanal scales (fig. 6). These are characteristic of the males of all known forms, but are subject to a wide variation in size in the several forms. They are usually flat, subcircular, and somewhat depressed.

Caudal scales. In all known forms the caudal scales are greatly enlarged, heavily keeled, strongly spinose, and imbricate; the scales become smaller as they progress laterally and terminally. The type of transition from the dorsal to the lateral caudal scales is important, as are the numbers of scales in each whorl. In several species, the extent to which the vertebrals encroach upon the basal portion of the tail is used diagnostically.

Cephalic scutellation (fig. 7). The following description is typical of the genus: cephalic plates fairly smooth, large; temporal region swollen; nostril above the canthus rostralis; frontal plate variable, transversely divided in some forms, entire in others, occasionally split vertically; a principal series of supraoculars, and immediately next to these another series scarcely smaller; supraoculars separated from frontal, frontoparietals, and parietals by one or two series of small granules; interparietal largest; superciliaries elongated, projecting, strongly imbricate; rostral wider than high; labials segmental; mental variable, in contact with both sub- and infralabials; gular region variable, scales granular or flat, imbricate or pavemented. Other cephalic scales are too variable to be of significance in most cases; occasionally the numbers of prefrontals and frontonasals are diagnostically employed.

Color. But two facts need be mentioned at this time. First, that with no known exception, the lizards of *Urosaurus* are very prone to exhibit a uniformly melanistic appearance. This appears in all known forms, and is often, but not always, correlated with habitat. When melanism occurs, it usually effaces all but the barest traces of pattern. Secondly, all *Urosaurus* males possess brightly colored abdominal blotches, usually of some shade of blue. The extent and intensity of these is used in the diagnosis of some forms. In one case, at least, the females also possess blue abdominal patches, but these are irregularly defined and not so intense as in the males of the species. The usual condition however, presents the female abdomen unicolor, usually grayish or white, and sometimes lightly maculated with a darker pigment in haphazard fashion.

Mensural data. With but a few exceptions, only four measurements are given: head length (tip of snout to posterior border of the auricular opening), head width (usually taken immediately anterior to the meatus auditorius), body length (tip of snout to vent), and hind leg length (measured from the anterior angle of insertion to the tip of the 4th toe, exclusive of the nail). With but a few exceptions, tail lengths are not given, principally because the tail is so often lacking in pre-

served specimens that such a feature would be of little use in many instances. Secondly, for the most part, a gross evaluation of the tail

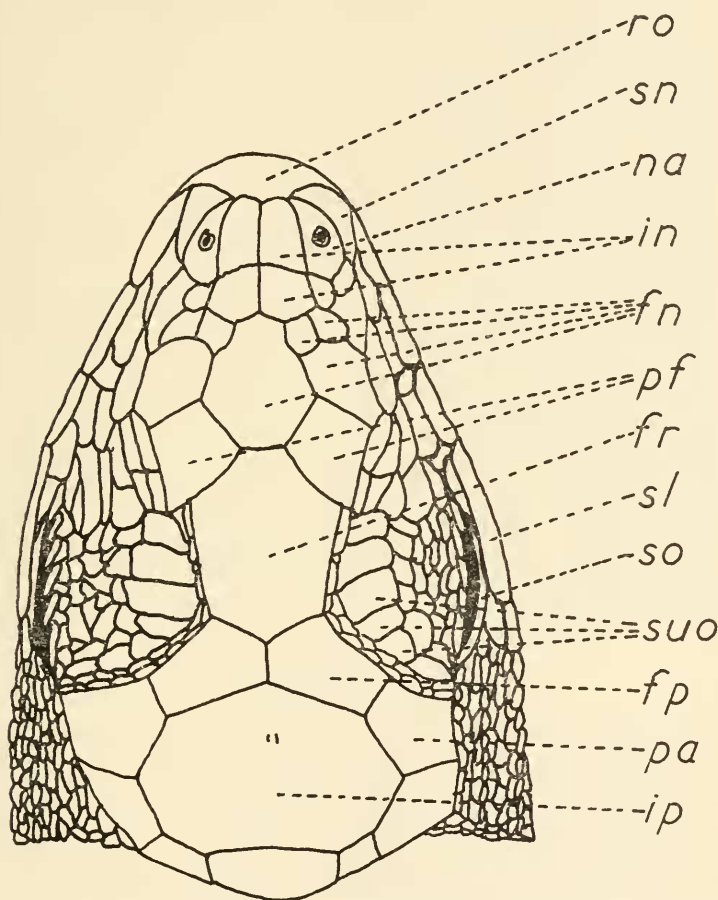


Fig. 7. Cephalic scutellation and nomenclature in *Urosaurus*. *ro*—rostral; *sn*—subnasal; *na*—nasal; *in*—internasal; *fn*—frontonasal; *pf*—prefrontal; *fr*—frontal; *sl*—supralabial; *so*—subocular; *suo*—supraocular; *fp*—frontoparietal; *pa*—parietal; *ip*—interparietal.

length, as, whether it is more than twice the combined head and body length, or less, is all that is needed. All measurements are given in

millimeters. For practically every form, the measurements of a sample of several adults of both sexes (unless specifically stated otherwise), usually fifty or more specimens, are given. In these cases, the weighted arithmetic mean is used for each figure; this "mean" is simply a more accurate representation of the commonly used "average".

The accumulation of large series of data has produced several facts of interest. From a practical viewpoint as regards these lizards, it has been noted that measurements and ratios obtained from them, based on the gross sampling of populations, are often misleading for the reason that such measurements and/or ratios are not constant in an individual, and hence population. Or this is better expressed perhaps, if it is said that these mensural data progress dynamically, and unless a specific age group *and* sex is employed, the results are distorted. Thus, throughout *Urosaurus* innumerable cases of positive and negative heterogony (depending on the organ under consideration) have been observed. Several of these heterogonal changes in size and proportion of age groups of the same and opposite sexes have been found to fit the formula $Y = bX^k$ (Simpson and Roe, 1939:367, *et seq.*). To present as much uniformity as possible, all measurements and ratios obtained from series of specimens have been taken from equal numbers of males and females (unless specifically stated to the contrary), which have been sexually mature animals, as adjudged by the condition of the gonads, or gross size when this has been known to be indicative of sexual maturity.

Genus UROSAURUS Hallowell

- 1852 *Uta* Baird and Girard, Proc. Acad. Nat. Sci. Phila., **6**, 126; Baird, Proc. Acad. Nat. Sci. Phila., 1858, December, p. 253; Baird, U. S. Mex. Bound. Surv., 1859, **2**, 7; Cope, Rept. U. S. Nat. Mus. 1898 (1900): 299; Van Denburgh, Occ. Pap. Calif. Acad. Sci., 1922, **10**, (1), 180; Mittleman, Jour. Wash. Acad. Sci., 1941, **31**, (2), 66.
- 1854 *Uro-saurus* Hallowell, Proc. Acad. Nat. Sci. Phila., **7**, 92 (type, *Uro-saurus graciosus* Hallowell); Van Denburgh, Occ. Pap. Calif. Acad. Sci., 1922, **10**, (1), 182 (subgenus).
- 1856 *Phymatolepis* Duméril, Arch. Mus. Hist. Nat. Paris, **8**, 548 (type, *Phymatolepis bi-carinatus* Duméril); Fischer, Abh. Nat. Ver. Bremen, 1882, **7**, 232; Boulenger, Ann. Mag. Nat. Hist., 1883, **5**, (11), 342 (subgenus).

Diagnosis. Small to medium-sized iguanid lizards with well developed, pentadactyl limbs adapted for climbing and running; digits with

well developed claws; head large with prominent eyes and auricular openings; a strong gular fold, often immediately preceded by one or more additional folds; gular fold and auricular orifices denticulated prominently; interparietal large; superciliaries imbricate; labials segmental; enlarged supraoculars in two principal rows; dorsal scalation homogeneous except in the median region where the scales become enlarged, prominently keeled, and usually imbricate; enlarged dorsals occasionally separated into two or more parallel series by a smaller, vertebral series of irregularly arranged, weakly carinated scales; ventral scales large, imbricate, occasionally spinose and/or carinate; tail long, slender, covered with greatly enlarged, keeled, spinose, imbricate scales; limbs with keeled, imbricate scales of moderate size, except on the antero-dorsal surfaces of the thighs and a narrow band on the tibiae, where the scales become greatly enlarged, and usually mucronate to spinose; lateral and dorsolateral dermal folds usually present, and often with a continuous or broken crest of enlarged tubercles; cervical region similarly with dermal folds and tubercles; males with enlarged postanal plates; post-femoral dermal pockets present in some species, absent in others, occasionally variable; a sternal fontanelle; xiphisternal abdominal ribs present; lateral and/or posterior teeth tricuspid; body and tail depressed; no dark post- or preaxillary blotches; males with prominent blue abdominal patches.

The following nomenclatorial changes are herewith proposed, and the respective species and subspecies recognized as valid:

Urosaurus ornatus ornatus Baird and Girard, 1852.

ornatus graciosus Hallowell, 1854.

ornatus symmetricus Baird, 1858

ornatus schottii Baird, 1858

ornatus linearis Baird, 1859

ornatus levis Stejneger, 1890

ornatus wrighti Schmidt, 1921

ornatus caeruleus Smith, 1935

ornatus schmidtii Mittleman, 1940

ornatus chiricahuae Mittleman, 1941

nigricaudus Cope, 1864

auriculatus Cope, 1871

irregularis Fischer, 1882

clarionensis Townsend, 1890

microscutatus Van Denburgh, 1894

gadovi Schmidt, 1921

unicus Mittleman, 1941

bicarinatus bicarinatus Duméril, 1856

bicarinatus tuberculatus Schmidt, 1921

bicarinatus nelsoni Schmidt, 1921

bicarinatus anonymorphus Mittleman, 1940

The genus is remarkably free of synonymous forms, only four of these having been proposed:

Uta gratioa Coues, Surv. W. 100th Merid., 1879, 5, 596. Synonym of *Urosaurus ornatus graciosus*.

Uta (Phymatolepis) lateralis Boulenger, Ann. Mag. Nat. Hist., 1883, 5, (11), 342. Synonym for *Urosaurus ornatus schottii*, see Mittleman (1941:136, *et seq.*).

Uta gularis Cragin, Bull. Washburn Lab. Nat. Hist., 1884, 1, 7.

Synonym of *Urosaurus ornatus schottii*, see Mittleman (*supra cit.*).

Uta parviscutata Cope, Rept. U. S. Nat. Mus. 1898 (1900): 324.

Synonym for *Urosaurus microscutatus*.

Within the genus, three major subdivisions, or complexes, are readily discernible:

<i>ornatus</i>	}	<i>ornatus</i> Complex	
<i>symmetricus</i>			
<i>linearis</i>			
<i>gracuosus</i>			
<i>levis</i>			
<i>wrighti</i>			
<i>caeruleus</i>			
<i>schmidtii</i>			
<i>chiricahuae</i>			
<i>clarionensis</i>	}	<i>nigricaudus</i> Complex	
<i>schottii</i>			
<i>nigricaudus</i>			
<i>microscutatus</i>			
<i>gadovi</i>	}	<i>bicarinatus</i> Complex	
<i>irregularis</i>			
<i>bicarinatus</i>			
<i>tuberculatus</i>			
<i>unicus</i>			
<i>nelsoni</i>	}		
<i>anonymorphus</i>			
<i>auriculatus</i>			

Distribution of the genus. Southern Texas west through New Mexico and Arizona to the desert portion of California bordering the Colorado River, north to Utah (and Wyoming ?) and southwestern Colorado; The Baja California peninsula; south through Mexico from the Rio Grande to the Mexican Plateau, and south along the western slopes of the Sierra Madre del Occidental, terminating at Tonolá, Chiapas; also the islands of Socorro, Clarion, María Madre, María Magdalena, Tiburón, Magdalena, Espíritu Santo, San Francisco, San Marcos, Coronado, Carmen, Danzante, Ballena, and San José, in the Pacific Ocean and Gulf of California.

Key to the Lizards of the Genus UROSAURUS

1. Enlarged antero-dorsal femoral scales smooth (Socorro Island, Revillagigedo Archipelago).

auriculatus

Enlarged antero-dorsal femoral scales strongly keeled 2

2. Enlarged dorsals in a single broad band, uninterrupted by an intervening series of smaller scales 3
- Enlarged dorsals separated into two or more parallel series by the presence of a vertebral series of smaller scales 7

3. Tail two or more times the length of head and body combined (the Colorado River valley from extreme southern Nevada to the Gulf of California; probably extreme northwestern Sonora; northeastern Baja California as far south as San Felipe).

graciosus

Tail less than twice the length of head and body combined . . . 4

4. Dermal folds, when present, not heavily crested with tubercles; blue abdominal patches only in males; enlarged dorsals comparatively small 5

Dermal folds present, always crested with tubercles of fairly large size; abdominal blue patches sometimes in females as well as males 6

5. Enlarged dorsals larger, from 17 to 24 in the length of head from tip of snout to posterior edge of interparietal; gular region in males deep yellow or orange (Cape region of Baja California; Magdalena, Espíritu Santo, and Ballena islands).

nigricaudus

Enlarged dorsals smaller, 32 to 36 in the length of head from tip of snout to posterior edge of interparietal; gular region in males usually blue (Baja California north of the Cape region, north to Borego Valley, California; the islands of San Marcos, Coronado, Carmen, Danzante, San José, San Francisco and Magdalena).

microscutatus

6. Four to seven rows of enlarged dorsal scales; abdomen of both sexes with a blue wash and/or blue patches; dorsolateral folds not converging in the sacral region (Jalisco and Michoacán).

gadovi

About three rows of enlarged dorsal scales; only males with a blue abdomen; dorsolateral folds converging in the sacral region to form prominent ridges ("Mexican Plateau").

irregularis

7. Enlarged dorsal scales in two or more prominent, nearly equal series on either side of the smaller vertebral series; frontal transversely divided; postfemoral dermal pocket almost invariably present; ventrals rounded posteriorly and never carinate

.....12

Enlarged dorsal scales in a single principal series on either side of the intervening vertebrae; frontal almost always entire; postfemoral dermal pocket often absent, occasionally rudimentary; ventrals often mucronate to spinose, often carinate in the latero-ventral areas.....8

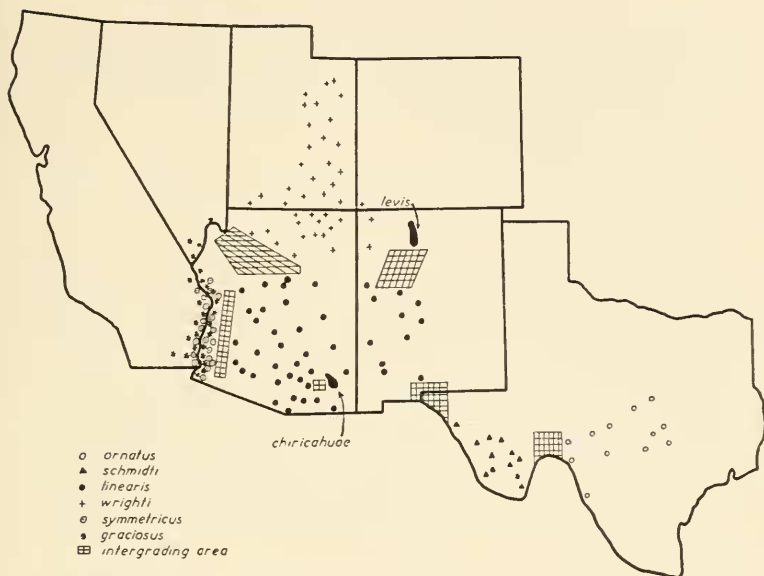
8. Enlarged dorsals commencing caudad of a line joining the anterior points of insertion of the fore-limbs; dorsals weakly keeled, rounded posteriorly, prominently paved; general habitus not at all rugose (Batopilas, Chihuahua).

unicus

Enlarged dorsals commencing cranial of a line joining the anterior points of insertion of the fore-limbs, or else equal with such a line; dorsals prominently keeled, usually mucronate or spinose, imbricate; ventrals imbricate; general appearance rugose...9

9. Form rugose; enlarged dorsals strongly carinate and prominently mucronate; tubercles of lateral and dorsolateral folds well developed; ventrals mucronate; gular surface generally stippled, with a light median area; blue abdominal patches of males quite extensive (Michoacán, Morelos, Puebla, Guerrero as far as Acapulco).

bicarinatus

Fig. 8. Distribution of *Urosaurus* in the United States.Fig. 9. Distribution of *Urosaurus* in Mexico.

General appearance somewhat less rugose; enlarged dorsals not so often mucronate; tubercles smaller, sometimes absent; ventrals less mucronate, occasionally rounded; gular surfaces evenly stippled; abdominal blue of males sometimes restricted to small sternal patches 10

10. Ventrals rounded; dorsolateral and lateral tubercles very poorly developed; enlarged dorsals commencing on the nape (Cuicatlán, Oaxaca).

nelsoni

Ventrals sub-mucronate to mucronate; dorsolateral and lateral tubercles well developed; enlarged dorsals commencing on the shoulders just craniad of a line joining the anterior points of insertion of the fore-limbs 11

11. Ventrals mucronate, prominently carinated laterally; gular scales with a tendency toward pavementation, especially anteriorly; gular surfaces evenly stippled; abdominal blue of males restricted to small sternal patches (Guerrero east of Tierra Colorada; Oaxaca, except the north-central portion; western Chiapas).

anonymorphus

Ventrals sub-mucronate (occasionally rounded), only faintly keeled on the lateral portions of the belly, or else not at all; gular scales imbricate; gular region with an even blue wash, and only barely flecked if at all; abdominal blue of males evenly distributed (Colima; Jalisco; southern Sinaloa; extreme southwestern Sonora).

tuberculatus

12. Enlarged dorsals commencing on the nape 13
 Enlarged dorsals commencing on the shoulders, or caudad of them 14
 13. Enlarged dorsals strongly keeled, scales of primary and secondary series almost equal in size; postfemoral dermal pocket absent or rudimentary; no prominent lateral pattern of dark whorls (Clarion Island, Revillagigedo Archipelago).

clarionensis

Enlarged dorsals not so rugose, scales of primary series prominently larger than those of the secondary series; postfemoral dermal pocket regularly present; a distinct lateral pattern of dark whorls (Tres Marias Islands; Tiburon Island; Sinaloa ?; Sonora, south of the line Caborca-Magdalena).

schottii

14. Tail two or more times the length of head and body combined (The Colorado River valley from extreme southern Nevada to the Gulf of California; probably extreme north-western Sonora; northeastern Baja California as far south as San Felipe).

graciosus

Tail less than twice the length of head and body combined . . . 15

15. Enlarged dorsals extending onto the basal portion of the tail for a distance equal to the length of the femur, or more; entire gular region, including the sublabials, a uniform bright blue (the northeastern quarter of Chihuahua).

caeruleus

Enlarged dorsals extending onto the basal portion of the tail for a distance equal to less than the length of the femur; entire gular region including the sublabials never completely blue 16

16. Three or four series (rarely two) of enlarged dorsals on either side of the vertebrae; enlarged dorsals not strongly keeled, not prominently imbricate; dorsolateral and lateral tubercles not affecting a diagonal arrangement; dorsolateral and lateral folds variable, but usually absent or poorly developed; general appearance not at all rugose 17

Two principal series of enlarged dorsals on either side of the vertebrae; enlarged dorsals strongly keeled and prominently imbricate; dorsolateral and lateral tubercles usually well developed and affecting a diagonal arrangement; dorsolateral and lateral dermal folds present; general appearance rugose 18

17. Enlarged dorsals quite flat, very weakly keeled, slightly imbricate, or just as often paved; dermal folds absent or rudimentary; dorsal basal tail scales barely or not at all differentiated from the lateral basal scales (Rio Arriba and Sandoval Counties, New Mexico).

levis

Enlarged dorsals more convex, more strongly keeled, more imbricate; dermal folds often present, with a fair degree of development; dorsal scales on the basal portion of tail abruptly differentiated from the much smaller, lateral basal scales (extreme southwestern Colorado; northwestern New Mexico; eastern and southern Utah; possibly extreme southern portions of Nevada and Wyoming; Arizona, to the south and east of the Colorado River in the northern portions of the state).

wrighti

18. Enlarged dorsals often irregularly arranged; lateral tubercles not affecting diagonal arrangements; average size less than 45 mm. snout to vent. 19
- Enlarged dorsals regularly arranged in parallel series on either side of the vertebrae; tubercles in parallel diagonal series; average size greater than 45 mm. from snout to vent. 20
19. Scales of primary series not twice as large as those of the secondary series; largest of the dorsals inferior in size to the enlarged femorals and tibials; ventral interhumeral and interfemoral areas immaculate, or but lightly stippled (Texas, west of the Pecos River in Brewster, Jeff Davis, and Presidio Counties; adjacent Chihuahua).

schmidtii

Scales of primary series almost twice as large as those of the secondary series; largest of the dorsals equal to, or larger than, the enlarged femoral and tibial scales; ventral interhumeral and interfemoral areas heavily maculated (Texas, east of the Pecos River; probably adjacent Coahuila and Nuevo Leon).

ornatus

20. Largest of the dorsals equal to, or larger than the enlarged femorals; vertebrae extending onto the basal portion of the tail for a distance equal to half, or slightly more, of the length of the femur; the entire gular region in males, except the sublabials, an intense blue; head length/head width ratio averaging 81% (Chiricahua and Dos Cabezos Mountains, Cochise County, Arizona).

chiricahuae

Largest of the dorsals inferior in size to the enlarged femorals; vertebrae extending only onto the rump, or but slightly further; no uniform intense blue color present in male gular region; head length/head width ratio averaging 75% or less. 21

21. Enlarged dorsals separated into two parallel series by the width of the vertebral series, which is greater in width than the broadest of the enlarged dorsals; prefrontals and frontonasals usually three each; general coloration pallid, light tan above, whitish below, males with bright blue abdominal patches; average head length/head width ratio 75.4%; average length, snout to vent, 55.1 mm. (Colorado River valley and deserts of southwestern Arizona and southeastern California; northeastern Baja California, and northwestern Sonora).

symmetricus

Enlarged dorsals separated by a vertebral series whose width is less than that of the largest of the dorsal scales; prefrontals two, rarely three (by the inclusion of an azygous); frontonasals five; general color variable, but usually dark brown or gray with dark cross-bands, and heavily stippled, spotted, or blotched ventrally; abdominal patches in males dark blue to indigo; average head length/head width ratio 70.6%; average length, snout to vent, 46.4 mm. (Arizona, south of Lat. 35°30', except in the Colorado River valley and desert; west to south-central New Mexico, and south to Sonora and Chihuahua as far as Lat. 31°).

linearis

UROSAURUS ORNATUS ORNATUS Baird and Girard

- 1852 *Uta ornata* Baird and Girard, Proc. Acad. Nat. Sci. Phila., **6**, 126 (part);
Cope, Rept. U. S. Nat. Mus. 1898 (1900): 315 (part).
1921 *Uta ornata ornata* Schmidt, Amer. Mus. Nov., **22**, 6 (part); Van Den-
burgh, Occ. Pap. Calif. Acad. Sci., **10** (1), 207, 1922 (part); Stejneger
and Barbour, Check List N. Amer. Amph. Rept., 1923: 52 (part); *ibid*,
1933:57 (part); *ibid*, 1939:62 (part); Mittleman, Herpetologica, 1940,
2, (2), 33; Mittleman, Jour. Wash. Acad. Sci., 1941, **31**, 77.

Type locality. Rio San Pedro (= Devil's River), Val Verde County, Texas.

Cotypes. USNM 2750 (male and female).

Diagnosis. One or two rows of enlarged, keeled, imbricate, irregularly arranged vertebral scales, extending from a point slightly caudad of the insertions of the fore-limbs posteriorly to the basal portion of the tail on which they continue for a distance equal to less than half the length of the femur; vertebrals bordered on either side by two series of larger scales which are keeled and prominently imbricate; enlarged dorsals not regularly dispersed; scales of primary series approximately twice as large as those of the secondary series; largest of the dorsals superior in size to the enlarged femorals and tibials; other dorsal scales very small, granular, and largely pavedment, or only but slightly imbricate, except for a series on the dorsolateral line which extends from a point anterior to the axilla posteriorly to the groin; anteriorly, this series is continuous and forms a dorsolateral ridge, but posteriorly it is broken up into small clusters of slightly enlarged, tubercular scales around a central, much larger, mucronate scale; diagonally arranged clusters of tubercles absent from lateral areas; on the lateral

line a few sparse clusters of barely enlarged tubercles; a fairly distinct lateral fold; two prominent series of cervical tubercles which extend posteriorly from the ear and join the dorsolateral series of enlarged scales immediately anterior to the axilla, although rarely they do not so merge, and instead retain their individual identity; ventral to the cervical tubercles and dorsolateral tubercles is usually a third, and often a fourth series of tubercles, which are almost ventral in position; posterior surfaces of thighs and arms covered with small granules similar to those on the sides and dorsum of body, while the antero-dorsal portions of the thighs, and a band around the tibiae are covered with large, mucronate, keeled, imbricate scales; ventrals smooth, rounded to submucronate, about equal in size to the scales forming the posterior edge of the gular fold; thirteen of the largest dorsal scales equal to the length of the head from snout to posterior border of occipital; frontal transversely divided; femoral pores 10-11; enlarged postanal plates in males conspicuous; a postfemoral dermal pocket regularly present. Coloration (alcoholic): dorsal surfaces of body and tail grayish to brown, with cross-bars of light brown which are edged with pale blue; head tan with a few pale blotches of blue or gray; limbs dorsally blue-gray with cross-bars of brown; venter of limbs and body whitish, venter of digits tan; tail mottled with light brown anteriorly, and uniformly shaded with the same posteriorly; chin and gular region mottled with blue and brown, labials a dark grayish blue which suffuses onto the lateral portions of the head; venter of limbs and tail, as well as interhumeral and interfemoral areas, heavily stippled with brown or gray; bright blue abdominal patches in males. Description from USNM 83117, male; 7 miles south of Babyhead, Llano County, Texas. Measurements of fifty adults, both sexes; head length, 11.15 mm; head width, 8.08 mm; snout to vent, 42.25 mm; hind leg, 27.60 mm.

Distribution. TEXAS: Llano, Burnet, Sutton, Kerr, Edwards, Hays, Comal, Bexar, Uvalde, Guadalupe, and Val Verde (east of the Pecos River) Counties. MEXICO: Probably Coahuila and Nuevo Leon.

Remarks. This subspecies is unaccountably absent from most collections of Mexican Urosauri. I have examined several specimens in the United States National Museum which bear only the noncommittal data "Border" or "Mexico"; these are undoubtedly referable to this race, but since they lack additional information, are useless in further delineating the range of *ornatus*. Baird (1859:7) mentions a specimen, USNM 2764, from Eagle Pass, Texas, which in itself would prove the certainty of the occurrence of *ornatus* in Coahuila

at least. The specimen from Sonora, USNM 2737, also mentioned by Baird (*loc. cit.*) is probably referable to *linearis* if the provenance is accurate; I have not examined it. A single specimen in the United States National Museum, USNM 78541, while an excellent example of this form, is not included here, since it purportedly was taken in Victoria County, Texas, which is considerably out of the known range of other available material. Until further collecting substantiates this record, I consider it best to temporarily delete it.

The type locality is here restricted to the Rio San Pedro, Texas, and the reference to Sonora omitted, on the grounds that Baird and Girard had a single specimen from this latter Mexican state, and at the time confused it with their "*Uta ornata*". The Sonoran form is *linearis*, which was later recognized and so named. The cotypes were both taken at the Rio San Pedro, and are so catalogued. Since they agree with other *ornatus* from the same general region, and since the Sonoran specimen available at the time of original description was not of the same race, the type locality is therefore restricted.

UROSAURUS ORNATUS SCHMIDTI Mittleman

1940 *Uta ornata schmidtii* Mittleman, *Herpetologica* 2, 2, 33, pl. 3, fig. 1

Type locality. Fort Davis, Jeff Davis County, Texas.

Type. USNM 32929, male.

Diagnosis. From original description: "Closely related to *Uta ornata* *ornata*, but differing from that race as follows: Enlarged dorsal scales arranged more regularly; the inner series of enlarged dorsal scales not twice as large as those of the outer series; largest of the dorsal scales occasionally equal to, but more often smaller than, the enlarged, keeled scales of the antero-dorsal surfaces of the tibia and femur; enlarged dorsal scales commencing well caudad of a line joining the anterior points of insertion of the fore-limbs. Lateral fold usually incomplete when present. Dorsolateral series of tubercles and enlarged scales usually quite prominent. Elongated series of tubercles on neck somewhat more prominent. Coloration of both sexes similar, in most respects, to that of *ornata*, save that the heavy ventral mottling of the interhumeral and interfemoral areas found in *ornata* is regularly lacking in *schmidtii*, or at best is represented by a light flecking of blue-gray. Measurements of holotype: Snout to posterior border of ear, 11.5 mm; head width, 9 mm; snout to vent, 44 mm; hind-limb (insertion to tip of 4th toe, exclusive of nail), 31 mm; tail, 70 mm." The measurements of twenty-five adults of both sexes

are as follows: head length, 10.65 mm; head width, 8.16 mm; snout to vent, 43.20 mm; hind leg, 28.70 mm.

Distribution. TEXAS: Brewster, Jeff Davis, and Presidio Counties. MEXICO: North of Lat. 29° in Chihuahua and possibly Coahuila.

Remarks. Mexican records for *schmidtii*, like in the case of *ornatus*, are based principally on specimens in the United States National Museum, bearing only the data "Border" or "Mexico". Apparently the only true record for this subspecies from Mexico, is that of Smith (1935:178), who reports "*Uta ornate ornata*" from near Samalayuca, Chihuahua. Since this is definitely out of the range of *ornatus*, and further, since the specimen bears no resemblance to Smith's *caeruleus*, and finally, since it is entirely within the normal range of *schmidtii*, it is accepted as a *bona fide* record. As I have mentioned previously (1940:34), Gadow's record (1905:194) for *Uta elegans* from Juarez, Chihuahua, which Smith interprets as probably being referable to *ornatus* (= *schmidtii*), is more probably *Uta stansburiana stejnegeri*.

Two of the original paratypes (USNM 32932-3) from El Paso County, Texas have been reexamined, and deleted from the range of this form, since they have been found to be intergrades with *lincais*, as some newly available material from southern New Mexico further indicates. However, *schmidtii* may still be taken in the southern portion of this county. Probably it will also be disclosed in Hudspeth and southern Culberson Counties.

UROSAURUS ORNATUS CAERULEUS Smith

1935 *Uta caerulea* Smith, Univ. Kan. Sci. Bull., **12**, (7), 172, pl. 26; Mittleman, Jour. Wash. Acad. Sci., 1941, **31**, 76.

Type locality. Thirty miles north of Chihuahua City, Chihuahua, Mexico.

Type. David H. Dunkle—Hobart M. Smith Coll. No. 132, now deposited in the Kansas University Museum.

Diagnosis. Two vertebral rows of enlarged, irregularly arranged, weakly carinated scales, extending from a point slightly cranial of a line joining the anterior points of insertion of the fore-limbs, posteriorly onto the base of the tail for a distance equal to the length of the femur; vertebrals bordered on either side by two series of enlarged, imbricate, weakly carinated scales, the primary series slightly larger than the secondary; largest of the dorsals inferior in size to the largest of the tibials; dorsolateral tubercles but slightly enlarged, and dispersed in irregular little clusters; ventrals rounded, smooth, imbricate;

frontal transversely divided; a post-femoral dermal pocket. Coloration of male (from original diagnosis, *loc. cit.*): "Entire ventral surfaces of body and tail, except chest, base of tail, and an area between the hind legs, sky blue; dorsum with about seven transverse black bars on each side; bars usually blue-edged." Measurements of type (Smith, *loc. cit.*): "Snout to anterior border of ear, 10.0 mm; head width 10.0 mm; snout to vent, 49.5 mm; hind leg, 30.0 mm."

Distribution. Northeastern Chihuahua, south of Lat. 29°.

Remarks. I have recently pointed out (1941:76) the close relationship between *schmidtii* and *caeruleus*, and mentioned the existence of intergrades between these two forms. At the time, I hesitated to formally designate *caeruleus* as a subspecies of the *ornatus* complex, because the extant material which indicated this intergradation bore no more explicit data than "Mexico", for the most part. I had hoped in the interim to acquire or locate specimens which would more precisely indicate the distribution of both these subspecies in Chihuahua. Unfortunately, such specimens have not yet become available. However, since some specimens at least have been seen which do indicate this relationship, and some definite action must be taken, *caeruleus* is here accorded the trinomial.

The subspecies *schmidtii* and *caeruleus* are quite easily separated. Thus, in *caeruleus*, the enlarged dorsals extend onto the basal portion of the tail for a distance equal to the length of the femur, or slightly more, whereas in *schmidtii* the distance traversed is rarely equal to half the length of the femur; largest of the dorsals inferior to the femorals in *caeruleus*, larger than the femorals in *schmidtii*; *caeruleus* with the gular blue wash including the sublabials, while *schmidtii* possesses the sublabials white or gray, but always distinct from the remainder of the gular region.

UROSAURUS ORNATUS LINEARIS Baird

- 1859 *Uta ornata* var. *linearis* Baird, U. S. Mex. Bound. Surv., 2, 7; Cope, Rept. U. S. Nat. Mus. 1898 (1900):315.
- 1921 *Uta ornata linearis* Schmidt, Amer. Mus. Nov., 22, 6; Mittleman, Jour. Wash. Acad. Sci., 1941, 31, 68; Mittleman, Proc. Biol. Soc. Wash., 1941, 54, 165.
- 1875 *Uta symmetrica* Yarrow, Surv. W. 100th Mer., 5, 569; Boulenger, Cat. Liz. Brit. Mus., 1885, 2, 213 (part); Cope, Rept. U. S. Nat. Mus. 1898 (1900):317 (part); Van Denburgh, Occ. Pap. Calif. Acad. Sci., 1922, 10 (1), 202 (part).

Type locality. Los Nogales, Sonora, Mexico.

Type. USNM 2759, lost or destroyed.

Neotype. USNM 62077, female, Los Nogales, Sonora, Mexico. F. J. Dyer, Collector.

Diagnosis. Superficially similar to *U. o. ornatus* and *U. o. schmidtii*, but principally differing as follows: enlarged dorsals usually commencing just craniad of a line joining the anterior points of insertion of the fore-limbs; enlarged dorsals in two very regular series on either side of the vertebrals; scales of the secondary series approximating those of the primary series in size; enlarged dorsals larger, more strongly carinated; cervical, dorsolateral, and lateral tubercles more strongly developed; lateral tubercles usually affecting a diagonal arrangement from axilla to groin; dorsolateral and lateral dermal folds prominent; blue abdominal patches of males more often fused medially; general appearance much more rugose and bristling; average snout to vent size larger, maximum size attained greater (56 mm. snout to vent, in largest recorded *linearis*; 51.5 mm. largest *schmidtii*; 46 mm. largest *ornatus*).

Distribution. ARIZONA: Widespread throughout the state south of Lat. $35^{\circ}30'$, and east of Long. 114° , except in Yuma County, where it occurs only as far west as Long. $113^{\circ}30'$. NEW MEXICO: Generally south of Lat. 35° , except for the southeastern quarter of the state bounded by Lat. 34° and Long. 106° . MEXICO: Sonora and Chihuahua, in the area bounded on the west by long. $113^{\circ}30'$, on the south by Lat. 31° (the line Reforma—Cananea—Sabinal—Lucero), and on the east by Long. $106^{\circ}30'$.

Remarks. The present subspecies has unduly suffered at the hands of various workers. Undoubtedly this is in a large measure due to the original description (*loc. cit.*), which merely said "Similar in markings to the described character of *U. ornata*, but with four linear interrupted black stripes instead of transverse bands." The error being in many cases, the presumption that the linear striping was supposedly the only specific character to be considered. The linear striping can be shown in nearly every subspecies of *ornatus* in the United States, and is a mere aberrant pattern variant. It is unfortunate that Baird rested the distinction of his species on such a character. None the less, Schmidt (1921) pointed out the distinctness of the central Arizonan and northern Sonoran form, and correctly applied the name *linearis* to this subspecies, thus distinguishing it from the Texas and Californian races (*ornatus* and *symmetrieus*). His attempt to revive *linearis* from the synonymy was short-lived, unfortunately, for Van Denburgh (1922:207) did not see fit to recog-

nize this distinction, and instead used "*symmetrica*" to designate the several races inhabiting the Colorado River valley, most of Arizona, northern Sonora and New Mexico; authors since Van Denburgh have uniformly accepted his nomenclature, the exception being Stejneger and Barbour (1923, 1933, 1939) who have properly restricted *symmetricus* to the Colorado River valley and desert, but accord *ornatus* a range extending from Texas to California.

The type of *linearis* was lost or destroyed some time prior to 1890; in the interests of future workers I have designated a neotype.

For a summary of certain mensural data of *linearis* see the discussions of the following two subspecies.

Throughout its range, despite a wide distribution and some degree of superficial variation, *linearis* remains remarkably constant in its chief diagnostic characters as given above. Occasionally local populations differ to a certain degree from the majority of available specimens, but in nearly every case, these aberrations can be shown to be of an incipient nature, and within the limits of variation of the subspecies. In one case, however, distinctive morphological trends are correlated with geographic isolation, such that the population is worthy of formal designation. This population has recently (Mittleman, 1941:165) been named, and is discussed below.

UROSAURUS ORNATUS CHIRICAHUAE Mittleman

1941 *Uta ornata chiricahuae* Mittleman, Proc. Biol. Soc. Wash., **54**, 165.

Type locality. Pinery Cañon, Chiricahua Mountains, 6000 ft., Cochise County, Arizona.

Type. MVZ 7751, male.

Diagnosis. "Resembling *Uta ornata linearis* superficially, but differing in the greater size of the enlarged dorsal scales; the extension of the vertebral series of enlarged scales onto the basal portion of the tail for a greater distance; greater proportionate width of the head; and a different arrangement of colors and pattern."

Description of type. Two, occasionally three, rows of enlarged, keeled, imbricate, irregularly arranged vertebral scales, extending from a point a trifle cranial of the insertions of the fore-limbs posteriorly onto the basal portion of the tail for a distance equal to half the length of the femur; vertebral scales bordered on either side by two series of regularly arranged, imbricate, and prominently keeled

scales which are larger than the vertebrales, equal in size to the enlarged femoral scales, and larger than the enlarged tibial scales; scales of the inner series of enlarged dorsals not much larger in size than those of the outer series, or else scales of both series approximately equal in size; other dorsal scales very small, granular, or flattened, lightly keeled and barely imbricate; on the dorsolateral line a series of enlarged scales which extends from a point just anterior to the axilla, posteriorly to a point just caudad of the groin; dorsolateral enlarged scales tubercular, and disposed around other larger, spinose, strongly carinated scales to form small clusters; distinct dorsolateral and lateral folds present; lateral areas with prominent series of enlarged tubercles diagonally dispersed; two short, prominent cervical series of tubercles, and below these, a lateral series of the same, and a ventrolateral series; lateral cervical tubercles merging with the series of tubercles of the dorsolateral line; posterior surfaces of thighs and arms covered with small granules, while the superior and anterior surfaces are covered with large, keeled, mucronate, imbricate scales; ventrals smooth, submucronate, about equal in size to the scales posteriorly bordering the gular fold; eleven of the largest dorsal scales equal to the length of head from snout to posterior border of occipitals; frontal transversely divided; femoral pores 12-12; postanal plates conspicuously enlarged; a postfemoral dermal pocket present. Coloration (alcoholic): Head light brown dorsally, with fine spots and streaks of a darker brown; dorsum of body, limbs, and tail varying from dark brown to a blue-gray, faintly splotted with light blue; the five irregular cross bands which extend transversely from the lateral fold to the enlarged dorsals and break on the median line of the back, dark brown edged with light blue; venter of limbs with a suffused blue-gray; chin, from anterior gular fold up to but not including the sublabials, a bright sky blue; two large, brilliant, light blue abdominal patches which are fused medially, and sprinkled with dark gray laterally; interhumeral and interfemoral areas uniformly shaded with dark gray, and a few flecks of blackish; preanal region with a light blue wash. Measurements of type: Snout to posterior edge of ear, 12 mm; head width 11.5 mm; snout to anus, 51 mm; hind leg (insertion to tip of 4th toe, exclusive of nail), 33.5 mm; tail (tip partially regenerated), 70 mm. Measurements of entire type series (thirty-seven adults, both sexes): Snout to posterior edge of ear, 11.32 mm; head width 9.16 mm; snout to anus, 47.70 mm; hind leg (insertion to tip of 4th toe, exclusive of nail), 30.80 mm. (these figures represent the weighted arithmetic means)."

“*Distribution.* Restricted to the type locality and the Dos Cabezos Mountains, Cochise County, Arizona.”

“*Remarks.* The present form is accorded a subspecific designation on the basis of certain specimens from nearby localities in Cochise County, which exhibit characteristics that must be considered intermediate between *chiricahuae* and *linearis*. In the main, however, such specimens are few, and *chiricahuae* is essentially different from the *linearis* population of Cochise County, as well as from other points in the distribution of this latter, parental form.

“The new subspecies exhibits certain mensural differences which are best illustrated by various ratios. Thus, the type series shows an average head length—head width ratio of 81 percent, the range being from 75 percent to 96 percent, with three specimens having a ratio of 75 percent, twenty-six specimens with ratios varying from 79 percent to 83.5 percent, and eight specimens with ratios between 84 percent and 96 percent. By comparison, a test sample of thirty-seven adult *linearis* of both sexes selected at random from a large series of specimens taken at Ramsey Canyon, Huachuca Mountains, Cochise County, Arizona, shows an average head length—head width ratio of 70.8 percent, the range being from 58.25 percent to 83 percent; only four specimens have ratios greater than 77.5 percent, while the great majority are in the quartile sector of the mean. Certain other ratios differ in *linearis* and *chiricahuae*, but none so markedly as this one. Test samples of *linearis* from Pima and Yavapai Counties, Arizona, as well as some from certain counties in New Mexico, agree well with the Ramsey Canyon sample in their morphological as well as mensural details, and exhibit about the same differences towards *chiricahuae*.

“The uniform blue color of the gular region in *chiricahuae* is very rare in *linearis*, and is usually replaced by a medial blotch of yellow or orange; similarly, the relative uniformity of color in the interhumeral and interfemoral regions in *chiricahuae* is, in the great majority of *linearis*, replaced by a heavy stippling or mottling of dark gray or brown.

“The subspecies *linearis* and *chiricahuae* are further differentiated by the nature of the enlarged dorsal scales; in the former race, these are usually smaller than the enlarged femoral and tibial scales, and only rarely equal them in size. In *chiricahuae*, the enlarged dorsals at least equal the femorals in size, and are consistently larger than the tibials. Further, the vertebral series of enlarged scales in *linearis* does not extend onto the basal portion of the tail for a distance equal

to much more than one quarter the length of the femur; in *chiricahuae*, the distance is equal to at least half the length of the femur, often more."

UROSAURUS ORNATUS SYMMETRICUS Baird

- 1858 *Uta symmetrica* Baird, Proc. Acad. Nat. Sci. Phila., December, p. 253; Boulenger, Catl. Liz. Brit. Mus., 1885, **2**, 213; Cope, Rept. U. S. Nat. Mus. 1898 (1900):317 (part); Stejneger and Barbour, Check List N. Amer. Amph. Rept., 1917:52.
- 1921 *Uta ornata symmetrica* Schmidt, Amer. Mus. Nov., **22**, 6; Van Denburgh, Occ. Pap. Calif. Acad. Sci., 1922, **10** (1), 202 (part); Stejneger and Barbour, Check List N. Amer. Amph. Rept., 1923:52; *ibid*, 1933:57; *ibid*, 1939:62.

Type locality. Fort Yuma, Imperial County, California.

Type. USNM 2760, lost or destroyed.

Neotype. USNM 2744a⁽¹⁾, male; Fort Yuma, Imperial County, California; M. Thomas, collector.

Diagnosis. Closely related to *Urosaurus ornatus linearis*, but differing from that subspecies as follows: vertebral series of enlarged scales wider than the breadth of the widest enlarged dorsal scale; usually three prefrontals and three frontonasals, although occasionally there is present an additional anterior pair of much reduced frontonasals whose presence is due to the fission of the frontonasals proper; average size larger, maximum size attained greater; coloration very pallid above and below.

Distribution. The Colorado River desert and valley in Yuma and Mohave Counties, Arizona; and Imperial, Riverside, and San Bernardino Counties, California; the Colorado River valley and desert to the delta, in Baja California and the Gran Desierto of Sonora.

Remarks. The type locality for *symmetricus* has been generally accepted (Stejneger and Barbour, 1939:62) as Fort Yuma, Arizona. Although it makes no practical difference which side of the river the type was actually collected on, there being no difference in the populations of either side, I am of the opinion that the proper point of origin of the type was Fort Yuma, Imperial County, California. The type locality, as originally stated (Baird, *loc. cit.*), was "Ft. Yuma, Cal."; Dr. Stejneger advises me in a letter that the change to the

¹ USNM 2744, sixteen specimens with the same data; neotype has been designated by "a" scratched on the tag.

Arizona locality was influenced by the fact that Baird subsequently (1859:7) referred this form to the "Gila River", which is in Arizona. It seems to me that this in no way changes the provenance of the type, for in addition to the original citation of the type locality, it may be that Baird meant the valley of the Gila River where it becomes an affluent of the Colorado, which could be construed to logically include old Fort Yuma, California. Further, in several other instances, much of Baird's data in the United States and Mexican Boundary Survey Report is erroneous; in some cases due to typographical error, in others apparently due to errata in information or data. Certainly, since there is little difference either way, and the point is purely technical, it seems best to adhere to the type locality as originally given.

A thorough investigation to find the type specimen, in 1890, by Dr. Stejneger, failed to disclose it. Since it has yet to be found, and was in all probability lost or destroyed, I have herewith designated a neotype.

The most northerly point from which I have seen *symmetricus*, is Needles, San Bernadino County, California. Mr. Klauber advises me in a letter that the specimens of "*Uta ornata symmetrica*" which he has recently recorded from Willow Beach, Mohave County, Arizona (1939:89), are actually referable to *U. o. graciosus*. I have examined some of the specimens of "*symmetrica*" reported by Cowles and Bogert (1936:37) from Black and Eldorado Cañons, Clark County, Nevada, and from Black Cañon and Travertine Springs, Mohave County, Arizona; I have similarly examined the "*Uta ornata*" reported by Yarrow (1883:56) from "Nevada"; I find that all of these specimens are intergrades of *U. o. linearis* x *U. o. wrighti*. Intergrades of *symmetricus* x *linearis* are apparently common from the Castle Dome, Chocolate, Dome Rock, and Plomosa Mountains, all in Yuma County, Arizona. This race is like many others of its genus, chiefly a boulder and cliff dweller. Although it will occasionally resort to small trees in the absence of its favorite medium, the ideal niche is on rocks, boulders, and cliffs.

The usual arrangement of prefrontals and frontonasals demands three of each; however, as noted above, occasional splitting will produce an additional, minute pair of frontonasals. Similarly, fusion is often encountered. The present race is most easily distinguished from *linearis* by the character of the enlarged dorsals which are widely separated on either side of the vertebrae, the distance separating the parallel rows of enlarged dorsals being greater than the width of the

widest enlarged scale; in *linearis* the distance between the opposite enlarged dorsal series is much less, due to the extreme crowding and imbrication of the vertebrals. Typically, *symmetricus* is a pale sandy color, with bright, but lightly tinted blue abdominal patches in the males. However, as previously noted, melanism is frequent, and many specimens, especially from the mountains, are a uniform blue-black dorsally and ventrally. This latter condition obtains in every known form of *Urosaurus*.

That *symmetricus* is a substantially and significantly larger form than *linearis* is brought out by the average snout to vent measurement of a series of 350 specimens of both sexes of the former race, which is 55.10 mm; the same measurement in a similar series of *linearis* averages 46.45 mm. A greater size is also attained by *symmetricus*, the maximum recorded in over 450 specimens being 63 mm. snout to vent, while the maximum size recorded for more than 1800 *linearis* is 56 mm. A somewhat wider head is also characteristic of *symmetricus*, the average head length/head width ratio of the series of 350 specimens noted above, being 75.4%; the same ratio in a random sample of 350 adult *linearis* of both sexes is 69.23%.

UROSAAURUS ORNATUS GRACIOSUS Hallowell

- 1854 *Uro-saurus graciosus* Hallowell, Proc. Acad. Nat. Sci. Phila., 7, 92.
1859 *Uta graciosa* Baird, U. S. Mex. Bound. Surv., 2, 7; Cope, Rept. U. S. Nat. Mus. 1898 (1900):325; Stejneger and Barbour, Check List N. Amer. Amph. Rept., 1917:50; *ibid*, 1923:50; *ibid*, 1933:56; *ibid*, 1939:61; Van Denburgh, Occ. Pap. Calif. Acad. Sci., 1922, 10 (1), 212.
1875 *Uta gratiosa* Coues, Surv. W. 100th Mer., 5, 596.

Type locality. Lower California (=Southern California).

Cotypes. ANSP 8550-1, both males.

Diagnosis. A *Urosaurus* of the *ornatus* complex, closely resembling *symmetricus* in scalation, size, and color, but distinguished by the tail length which is two or more times the length of the head and body combined, and by the absence of vertebral scales separating the enlarged dorsals into two parallel series.

Distribution. The Colorado River desert and valley in NEVADA: Clark County; ARIZONA: Mohave and Yuma Counties; CALIFORNIA: San Bernadino, Riverside, Imperial and San Diego (*fide* Van Denburgh, 1922:214) Counties; MEXICO: Baja California along the Gulf of

California as far as San Felipe; probably the portions of Sonora adjacent to the Colorado River.

Remarks. The close alliance, yet differentiation existing between *graciosus* and *symmetricus* is a remarkable attestation to the sharp ecological preferences and consistencies characteristic of *Urosaurus* as a whole. The two subspecies are undeniably very close, and I can only consider them as equivalent offshoots of the same stock, of about equal age. Yet despite this superficial and possibly genetic nearness, *graciosus* and *symmetricus* remain distinct throughout the greater portion of their mutual range. Insofar as I can determine, although doubtless there are other contributing factors, the chief isolating mechanism seems to be simply a matter of ecological preference — *graciosus* being consistently a tree and shrub dweller, and *symmetricus* displaying an obvious preference for boulders and cliffs. In the southern portion of the range these ecological distinctions merge, and intergradation takes place, having been observed chiefly from the vicinity of Yuma, Arizona. Yet in itself this is further confirmation of the ecological postulation, for in the intergrading region there is not the abundance of distinctive ecological niches available for both forms which are found throughout the greater portion of the range. Yet even in the vicinity of Yuma, both *graciosus* and *symmetricus* to a large extent remain distinct, and intergrades are notably few.

When intergradation occurs between *graciosus* and *symmetricus*, the intergrades possess the distinctively long tails of the former race, but indicate their aberration by the nature of their enlarged dorsal scales, which tend to become smaller along the median line, and simulate the vertebral series characteristic of *symmetricus* and typically lacking in *graciosus*. Measurements and proportionate data for the two races are about the same, save for a somewhat narrower head in *symmetricus* and longer tail in *graciosus*. In coloration and pattern, both forms are nearly identical.

UROSAURUS ORNATUS WRIGHTI Schmidt

- 1921 *Uta wrighti* Schmidt, Amer. Mus. Nov., **22**, 3.
1922 *Uta levis* Van Denburgh, Occ. Pap. Calif. Acad. Sci., **10** (1), 208;
Stejneger and Barbour, Check List N. Amer. Amph. Rept., 1923:51;
ibid, 1933:56; *ibid*, 1939:61.

Type locality. Grand Gulch, 4000–5000 ft., San Juan County, Utah.

Type. AMNH 18097, male.

Diagnosis. Enlarged dorsal scales commencing well caudad of a line joining the anterior points of insertion of the fore-limbs; usually two vertebral series, the scales of which are very small, weakly keeled, and bordered on either side by a primary and two or three secondary series of enlarged dorsals, which are weakly to moderately keeled, and slightly imbricate; enlarged dorsals very gradually merging with the remainder of the dorsal scales; cervical tubercles moderately developed; dorso-lateral and lateral tubercles and dermal folds absent or rudimentary; lateral scales at base of tail abruptly smaller than dorsal basal scales. Coloration (alcoholic) of male: Dorsum of head, body, and limbs and tail usually gray-blue, occasionally light tan or blue-black; limbs, body and tail barred with narrow cross-bands of dark blue or grayish; supralabials and infralabials suffused with white, which diffuses through part of the sublabials and gular region; median gular region with a yellow, orange, or whitish light spot; abdominal blue patches fused medially for the greater part of their length; interhumeral and interfemoral regions pale gray, mottled or not, but usually with dark gray or blue; venter of limbs and tail lighter than dorsal surfaces. Measurements of 200 adults, both sexes: Head length, 12.05 mm; head width 8.62 mm; snout to vent, 48.30 mm; hind leg, 30.70 mm.

Distribution. COLORADO: Montezuma County; NEW MEXICO: San Juan and McKinley Counties; UTAH: Uintah, Duchesne, Carbon, Emery, Grand, San Juan, Wayne, Garfield, Kane and Washington Counties; ARIZONA: Apache, Navajo, Coconino, and probably Mohave Counties, north of Lat. $35^{\circ} 30'$.

Remarks. Intergradation with *U. o. linearis* is common throughout the northern portion of Mohave County, Arizona, as well as in the vicinity of San Francisco Mountain, Coconino County, Arizona. Other cases of intergradation of *linearis* x *wrighti* have been previously discussed. Specimens from the vicinity of St. George, Washington County, Utah, are aberrant, and indicate the trend towards *linearis*. This subspecies may also be expected to occur in extreme southwestern Wyoming, as I have seen specimens from Vernal, Uintah County, Utah, which is but forty miles south of the Utah-Wyoming line. How far west it ranges is open to speculation; it seems quite possible that it will be found in northern Clark and southern Lincoln Counties, Nevada, at least.

The present subspecies has suffered unmerited oblivion at the hands of most authors, who have uniformly followed Van Denburgh (1922: 209) in regarding this form as being synonymous with the older *levis*, from which it is quite definitely distinguishable.

This form is consistently a dweller of large boulders and open cliffs. In the Navajo Country of Arizona and Utah, it was only in these associations that *wrighti* could be found, showing an extreme predilection for the vertical habitat. Indeed, we found this lizard extremely common along the sheer and overhanging cliffs which jut to meet the water, along the upper reaches of the Colorado River, from the point of affluence with the San Juan River in Utah, to Lee's Ferry, Arizona. In the Navajo Country it is one of the commonest of all reptiles, and is the first to appear in the morning, and one of the last to retire at dusk. Knowlton (1934:11; 1938:236) has shown that this subspecies is an important insect pest control agent in Utah. Eaton (1935:10) has reported that courtship and copulation took place between a pair observed on June 14th, at an elevation of 6000-6300 ft., in northern Navajo County, Arizona.

UROSAURUS ORNATUS LEVIS Stejneger

- 1890 *Uta levis* Stejneger, N. Amer. Fauna, **3**, 108; Cope, Rept. U. S. Nat. Mus. 1898 (1900):313; Stejneger and Barbour, Check List. N. Amer. Amph. Rept., 1917:50; *ibid*, 1923:51 (part); *ibid*, 1933:56 (part); *ibid*, 1939:61 (part); Van Denburgh, Occ. Pap. Calif. Acad. Sci., 1922, **10** (1), 208 (part); Schmidt, Amer. Mus. Nov., 1921:6.

Type locality. Tierra Amarilla, Rio Arriba County, New Mexico.

Type. USNM 11474, male.

Diagnosis. Most closely related to *Urosaurus ornatus wrighti*, but distinguished as follows: enlarged vertebrae and the three or four series of enlarged dorsals bordering them on either side, extremely flat, very weakly keeled, barely imbricate, or often pavemented; cervical, dorso-lateral, and lateral tubercles absent or very poorly developed; lateral fold occasionally present, but then very weakly differentiated; dorsal scales of basal portion of tail very gradually merging to the lateral basal scales, without any noticeable demarcation between dorsal and lateral scales. Coloration (alcoholic) of male: olivaceous tan above, slightly darker beneath; dorsum with six to eight greenish brown wavy cross-bands, which break on the vertebral line; abdominal patches bright blue, usually not fused medially. Measurements of ten adults (six males, four females): head length, 10.7 mm; head width 7.3 mm; snout to vent, 42.8 mm; hind leg, 28.6 mm.

Distribution. NEW MEXICO: Rio Arriba and extreme northern Sandoval Counties.

Remarks. The present subspecies is accorded the trinomial on the basis of specimens from extreme southern Sandoval and Torrance Counties, New Mexico, which are intermediate between this form and *linearis*. Doubtless too, collecting in southwestern Colorado will reveal further intergradation between *levis* and *wrighti*.

Urosaurus o. levis has had a peculiar history which I believe is principally attributable to the rarity of this form in collections. Prior to Schmidt's naming of *wrighti* and Van Denburgh's synonymizing of this race with *levis*, *levis* was properly considered the rare lizard it is. When, however, the form which ranges so widely and commonly over much of Colorado, Utah, and Arizona (*wrighti*) was believed conspecific with *levis*, this latter name crept into the literature quite rapidly. Thus, Van Denburgh (1922), Knowlton (1934, 1938), Woodbury (1931), Smith (1935) and others, have variously discussed and figured supposed *levis*; the fact remains that very few of these references more than touch in part on any phase of the natural history or taxonomy of *levis*, nearly all the references bearing actually on *wrighti*.

Despite diligent inquiry and investigation, I have been able to discover only eleven specimens of *levis* in various collections. Ten of these specimens are adults, and one is a juvenile. All of these specimens have been taken in the comparatively rigidly proscribed area composed of Rio Arriba and northern Sandoval Counties, New Mexico. These specimens serve to show that while the alliance between *levis* and *wrighti* is unquestionably close, the distinguishing characters given are actually present and constant. Further, *levis* which is an end form of *wrighti* (again through ecological isolation), is apparently closely restricted to its own distinctive region, and is not a common animal. Whether the rarity of this subspecies in collections indicates also its rarity in nature, or simply a lack of collecting in the region it inhabits, I cannot say; none the less, the distinctions between *levis* and *wrighti* are real and correlated with geographic distribution.

While I hesitate to offer mensural data based on ten specimens of lizards as highly variable as the *Urosauri*, it may be said that *levis* is seemingly a smaller animal, with a proportionately narrower head, and proportionately longer hind leg than *wrighti*.

The type of *levis*, as indicated previously, is actually a male. Cope (1900:314) has correctly figured the type specimen, but in his table on the same page has reversed the data; thus, USNM 11474, the type, actually is a male, and USNM 8554, a paratype, is a female.

UROSAURUS CLARIONENSIS Townsend

1890 *Uta clarionensis* Townsend, Proc. U. S. Nat. Mus., **13**: 143.

Type locality. Clarion Island, Revillagigedo Archipelago, Mexico.

Type. USNM 15904, male.

Diagnosis. Enlarged dorsals strongly carinate, prominently imbricate, and very regularly dispersed in two parallel series on either side of a series of very small vertebrae which commence on the nape; scales of primary series well developed, and slightly larger than those of the secondary series; largest of the dorsals considerably larger than the enlarged femorals and/or tibials; dorsolateral tubercles very well developed, as are those of the lateral fold; between the dorsolateral tubercles and the lateral fold are short series of tubercles which occasionally present a diagonal arrangement; frontal transversely divided; lateral abdominal scales mucronate and carinate. Coloration (alcoholic) of male: general over-all color blue above and below; limbs and tail lightly ringed with gray or black; dorsum with longitudinal dark streaks. Measurements of six adults (three of each sex): head length, 13.78; head width, 10.55 mm; snout to vent, 54.50 mm; hind leg 41 mm.

Distribution. Restricted to the type locality.

Remarks. This species is most closely allied to *schottii*, of existing forms, and shows no close affinity for the neighboring *auriculatus* of Socorro Island. Because of this, it assumes quite some importance in the phylogenetic aspects of the Urosauri, and will be dealt with more thoroughly in connection with this problem.

It can be confused with no other known *Urosaurus*, by reason of its distinctive morphology and greatly restricted habitat. It should be added that although the postfemoral dermal pocket is absent in most specimens, a few examples possess a very small whorl of reduced scales which may be interpreted as a rudimental pocket.

I have not been able to learn anything of the natural history of this species.

UROSAURUS ORNATUS SCHOTTII Baird

1858 *Uta schottii* Baird, Proc. Acad. Nat. Sci. Phila., **10**: 253.

1883 *Uta (Phymatolepis) lateralis* Boulenger, Ann. Mag. Nat. Hist., **5**, (11): 342.

1884 *Uta gularis* Cragin, Bull. Washburn Lab. Nat. Hist., **1**: 7.

1885 *Uta lateralis* Boulenger, Cat. Liz. Brit. Mus., **2**: 214; Schmidt, Amer. Mus. Nov., 1921:6.

1922 *Uta ornata lateralis* Van Denburgh, Occ. Pap. Calif. Acad. Sci., **10** (1): 199; Mittleman, Jour. Wash. Acad. Sci., 1941, **31**: 66.

1941 *Uta ornata schottii* Mittleman, Copeia, **3**: 138.

Type locality. Magdalena, Sonora, Mexico.

Type. USNM 2761, destroyed sometime prior to 1889. (See Mittleman, 1941:138).

Diagnosis. One to three vertebral rows of enlarged, imbricate, carinate, irregularly arranged scales, extending from the nape posteriorly onto the base of the tail for a distance equal to about half the length of the femur, and bordered on either side by two series of enlarged dorsals, of which the primary series is considerably the larger; largest of the dorsals greater in size than the enlarged femorals and tibials; two or three elongated series of thoracic tubercles; a dorsolateral series of enlarged, mucronate tubercles, extending from the supra-axillary or thoracic region to the basal portion of the tail; several lateral series of enlarged, spinose granules; ventrals abruptly differentiated from the granular laterals; abdominal and gular scales prominently imbricate and submucronate; frontal typically divided transversely; post-femoral dermal pocket regularly present. Coloration (alcoholic) of male: six to nine dark spots on the dorsolateral line from axilla to groin; a vertebral series of smaller, alternating spots extending from the nape to the basal portion of the tail; dorsolateral and lateral spots on both sides usually joined by undulated brown bands, which are occasionally broken medially; dorsal coloration of body and limbs generally light brown or gray, or occasionally a uniformly rufescent dark brown which completely obliterates any semblance of pattern; limbs barred above with dark brown; dorsum of tail similar to dorsum of body, and lightly ringed with pale brown; lateral areas a light blue-gray, and lightly streaked with irregular brown patches; abdomen with two elongate, light blue patches, which may or may not be fused medially; rostral and supralabials white, this color extending posteriorly in a narrow streak to the insertion of the fore-limbs; infralabials flecked with gray; gular region anterior to the fold, light blue; underside of limbs, tail, and interhumeral and interfemoral areas, whitish. Measurements of fifty adults, both sexes, insular and mainland: head length, 12.6 mm; head width, 9.6 mm; snout to vent, 49.5 mm; hind leg 35.9 mm.

Distribution. Tres Marias Islands; Tiburón Island; Sinaloa (Boulenger, 1883:342); Sonora, south of the line Caborca-Magdalena.

Remarks. I have recently shown (1941:138) that the long-standing *Uta lateralis* Boulenger, 1883, is synonymous with the older *Uta schottii* Baird, a name for many years considered of puzzling identity. Since *lateralis* was demonstrated to intergrade extensively with *linearis* (Van Denburgh, 1922:199; Mittleman, 1941:68), subspecific designa-

tion was made; similarly, therefore, *schottii* assumes the trinomial of the name it has replaced.

The extent of the southerly distribution of *schottii* remains entirely uncertain. Similarly, the status of *Urosauri* from Sinaloa generally, is an unknown quantity. There is an utter dearth of material from this Mexican state, and until the gap is filled, we are confronted with several inexplicable problems. For instance, Boulenger (*loc. cit.*) has recorded *schottii* (under *lateralis*) from Presidio de Mazatlán, Sinaloa, which is several hundred miles south of other known records for this subspecies, except for those from the Tres Marias Islands. On the other hand, *U. b. tuberculatus* has been taken at the Presidio, which previously constituted a new northerly record for the subspecies, until I reported it from extreme southern Sonora, which again moved the distribution of *tuberculatus* several hundred miles northward. Such a distribution is paralleled by *Sceloporus nelsoni* (Smith, 1939:364), but is not duplicated by any of the *Urosauri*. It is entirely possible that further collecting in Sinaloa will explain these queer problems of distribution, and possibly show that *schottii* and *tuberculatus* are simultaneously distributed throughout this state and extreme southern Sonora, but are effectively separated by ecological and/or physiological barriers.

Comparisons made between large series of insular and mainland *schottii* reveal only slight mensural differences, which are neither constant nor marked enough to warrant any distinctions being made between the two populations.

U. o. schottii and *U. o. linearis* are easily separated. Thus, *schottii* possesses the enlarged dorsals on the nape, whereas in *linearis* they commence about equal with a line joining the anterior points of insertion of the fore limbs; *schottii* possesses the scales of the primary series about twice as large as those of the secondary series, while *linearis* has the scales of both series about equal in size. In *linearis* there is no prominent pattern of dorsolateral spots in series, while in *schottii* such a pattern is distinctive and always present, save in melanistic individuals.

Summary of the *ornatus* Complex

The *ornatus* complex is that group within the genus *Urosaurus* characterized by two or more principal series of enlarged dorsals on either side of the vertebral series, or else with a uniform band of enlarged scales which is not longitudinally separated by a vertebral series; in addition to these premises, members of the *ornatus* complex regularly

possess a postfemoral dermal pocket, with the exception of one form in which it is occasionally present in a rudimentary condition; further, the frontal plate is always transversely divided.

A critical study of *Urosaurus* indicates that *schottii* is at present most nearly akin to the primitive form which largely gave rise to the modern genus. To further corroborate this view, available data conform to several of Adams' criteria (1902), and indicate the general region composed of western Sonora, the adjacent portion of Baja California, and northern Sinaloa as the likely center of origin and dispersal of *Urosaurus*. It is notable therefore, that *schottii* largely populates this region, almost to the complete exclusion of other known forms.

The form *schottii* seems to have developed two very distinctive genetic lines; one characterized by the *ornatus* complex, the other by the *bicarinatus* complex. Further, this genetic divergence must have taken place at a relatively early date, for on the neighboring Clarion and Socorro islands of the Revillagigedo Archipelago, we find the very dissimilar *clarionensis* and *auriculatus* respectively, the former belonging to the *ornatus* complex, and the latter to the *bicarinatus* complex. Through the agency of the specific distinctness of these two forms, and available knowledge concerning the geological history of west-coast Mexico, the period of development of the two diverse genetic lines in *Urosaurus* can be placed as having occurred sometime between the late Oligocene and the early Miocene, for in this era the solid mass of land which composed modern west-coast Mexico and extended as far west as the Revillagigedo Archipelago became immersed, and formed the modern Californian peninsula as well as the numerous Gulf and Pacific islands.

Probably during the early Miocene *schottii*, or more properly perhaps, the pre-*schottii* form, commenced to successively spread and investigate the land masses to the north and south of the center of origin. To the north, the proliferation of the line *linearis-wrighti-levis* formed, while on the east-west axis, *schmidtii-ornatus-caeruleus* developed to the east, and *symmetricus-graciosus* to the west; *chiricahuae* is an end form of *linearis*, and only owes its morphological distinctness to a forced inbreeding necessitated by ecological limitations and restrictions. The species *clarionensis* developed early in the history of the group, and bears a closer resemblance to *schottii* than does any existing *Urosaurus* known. The *ornatus* complex will therefore be seen to follow a pattern of multiplication of species through isolation and mutation of older, pre-existing species (Dunn, 1934), and to present an orthogenetic line of dynamic status.

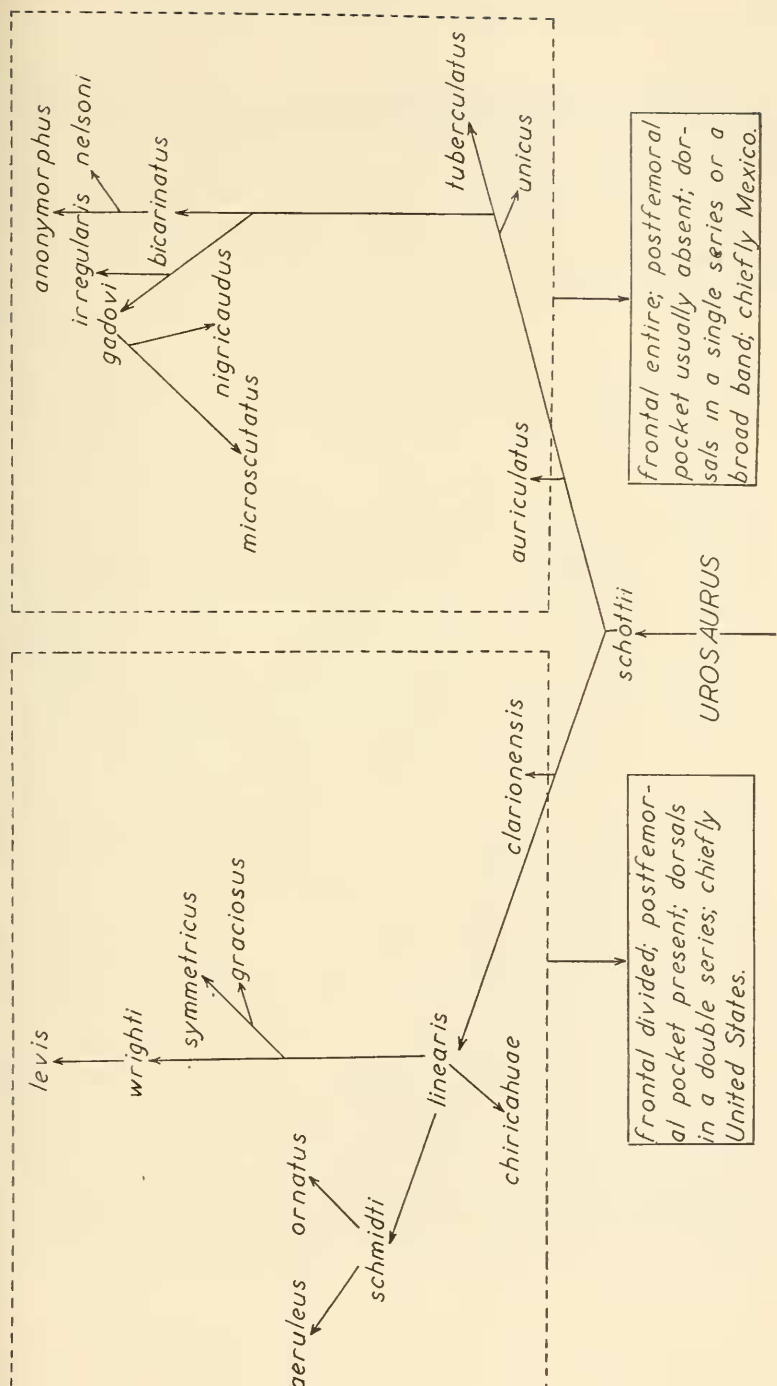


Fig. 10. Probable phylogeny and interspecific relationships in *Urosaurus*.

The trend in the *ornatus* complex has been, from south to north, and from the central portion to peripheral sectors, towards a decrease in the size of the enlarged dorsals, an increase in the size of the vertebrals to ultimately produce a band of dorsal scales of uniform size (notably attained in *graciosus*), a loss of heavy melanins dorsally, and a greater degree of gular pigmentation. Further, peripheral forms tend to develop proportionately wider heads, longer legs, and a lesser degree of carination on the dorsal scales.

UROSAURUS GADOVI Schmidt

1921 *Uta gadovi* Schmidt, Amer. Mus. Nov., 22: 3.

Type locality. Cofradia, Jalisco, Mexico.

Type. AMNH 20355, male.

Diagnosis. Frontal usually entire, rarely split transversely into a large anterior portion and a much smaller posterior section; four to seven rows of enlarged dorsal scales along the median line, of which the median row is largest, and the remainder progressively diminish in size; no vertebrals separating the enlarged dorsals into parallel longitudinal series; enlarged dorsals extending posteriorly from the shoulders to the basal portion of the tail, or often ending in the sacral region; enlarged dorsals smaller than the enlarged femorals, and equal to or smaller than the tibials; external to the enlarged dorsals are several poorly defined, slightly enlarged clusters of tubercles, extending from axilla to groin; on the dorsolateral line of the neck and body a dermal fold crested with numerous small series of enlarged tubercles interspersed with larger, flat, mucronate scales; usually another, short fold, restricted to the supra-axillary region; along the lateral areas are three to five longitudinal series of clustered tubercles; lowest series of tubercles often in contact with the ventrals; ventrals abruptly differentiated from the lateral granules; gular scales flat, and largely paved; scales of the gular fold elongate, mucronate, imbricate, and laterally, faintly keeled; ventrals imbricate, mucronate to spinose, and faintly keeled especially laterally, males with rather small postanals; post-femoral dermal pocket absent. Coloration (alcoholic): Dorsal color ranging from slatey gray (in melanistic specimens) to a lighter brownish gray, or brown; head, tail, and median line of back slightly lighter; three to six blackish cross-bands, about evenly distributed from cervical region to sacrum, these being about as wide as three to five of the largest dorsals; in all except the darkest specimens, the dorsolateral, lateral, and ventrolateral surfaces are maculated with whitish areas,

these usually being restricted to small clusters of enlarged, tubercular scales which dot these areas; entire labial and gular region, save for a rounded area immediately anterior to the gular fold, spotted and irregularly streaked with black, these being heavier in the males; venter of limbs, basal portion of tail, and interhumeral and interfemoral areas whitish and lightly maculated with dark flecks; abdomen, from axilla to groin, covered with an overlay of blue in both sexes, but anteriorly more prominent and assuming an ovoid outline in males; tail faintly circled with narrow brown bands. Because there is a greater quantitative dimorphism between the sexes of this species, than in any other form yet observed, the mensural data have been correlated as given below, based on forty specimens (twenty-two males, eighteen females) of adults:

Measurement or ratio	males	females	mean of all specimens
Head length	10.5— 11.7 —13.0	9.0— 10.4 —12.5	11.17
Head width	8.0— 9.4 —10.0	7.0— 8.3 —10.0	8.92
Head length/head width	75.0— 80.5 —87.0	75.0— 79.4 —87.0	79.25
Snout to vent	40.0— 46.5 —52.0	34.0— 40.2 —51.0	43.35
Hind leg	23.0— 28.1 —30.5	21.0— 24.6 —29.0	26.22
Tail length	68.0— 73.5 —80.0	51.0— 61.4 —77.0	67.46

The left and right figures represent the lowest and highest measurements and/or ratios obtained; bold figures are the means.

Distribution. Jalisco and Michoacán, Mexico.

Remarks. *Urosaurus gadovi* has been almost unknown since the time of its original description; save for the type and five other specimens (two in very poor condition), no other material has been extant until very recently. In 1939, Dr. Hobart M. Smith had the good fortune to collect thirty-seven specimens of this species, of which thirty-five were sexually mature adults, at Apatzingan, Michoacán. These have benefited the present study enormously, and have made it possible to present a more complete picture of the variation of this form.

This species possesses smaller postanals (in males) than any other form in the genus, these scales being so small in immature specimens that determination of sex must be made by dissection. It is further unique in that it is the only species in the genus wherein both males and females possess the blue abdominal coloration normally restricted to the males alone.

Urosaurus gadovi cannot be confused with any species of the genus occurring on mainland Mexico. It is geographically remote from any

related species of the genus; so much so, in fact, that several pertinent facts in the phylogeny of *Urosaurus* remain a matter of conjecture and uncertainty. In the main, however, *gadovi* appears most closely allied to *U. nigricaudus* of Baja California, and is probably a mainland remnant of the primitive *Urosaurus* stock which gave rise principally to certain peninsular species.

UROSAAURUS IRREGULARIS Fischer

- 1882 *Phymatolepis (Uta) irregularis* Fischer, Abh. Nat. Ver. Bremen, **7**: 232, pl. 17, figs. 1-4.
1885 *Uta irregularis* Boulenger, Cat. Liz. Brit. Mus., **2**: 216; Schmidt, Amer. Mus. Nov., 1921, 22:6; Smith, Zoöl. Ser. Field Mus. Nat. Hist., **24**, (4): 23.

Type locality. “. . . aus dem Hochlande von Mexico. . . .”

Type. Municipal Natural History Collection of Bremen no. 437.

Diagnosis. (from original description): dorsum covered with carinated scales; along the dorsal median line larger keeled scales not arranged in regular rows; two longitudinal ridges converging posteriorly on the back anterior to the pelvic region; the dorsal median series of irregular, larger scales diffusing more and more towards the base of the tail on both sides; after the fifth verticil of the tail these scales become smaller, more mucronate, and less noticeable, and, commencing at this point they arrange themselves with those of the ventral surface into complete verticils which surround the tail up to the tip. Ground color greenish-gray, ventrally lighter; on the back, three narrow, black, oblique stripes, the laterad-most of which diverge outward posteriorly; gular region speckled and marbled with yellowish gray and black; ventral side light gray.

Distribution. “The plateau of Mexico.”

Remarks. The above description is condensed from the original one of Fischer's, and only those passages which are of any practical use are given. I have utilized a literal translation of Fischer's phraseology; for his kind help in the translation of the original paper, I am indebted to Dr. Eugen H. Mueller, of Ohio University.

The status of *irregularis* is indeed a puzzling one, and I have given the problem much thought, attacked it from every angle, and have gotten a uniform result: that no opinion whatsoever can be offered concerning this animal. Fischer's description is a lengthy mass of verbiage, replete with minute data, but lacking such information as the sex of his

type, measurements, etc. It seems certain, however, if the description and plate are at all accurate, that the type was a female, for Fischer's notes conspicuously lack any reference to distinctive abdominal coloring, in an otherwise complete color description. Further, the ventral figure in the plate does not show enlarged postanals.

Other than the original description and plate no other information on this species is available. I have not seen the type (if it is indeed still in existence), nor have the few museum catalogues which bear entries of "*irregularis*" borne fruit. Smith (1939:23) reported *irregularis* from Laguna Coyuca, near Acapulco, Guerrero (FMNH 25884), but this specimen was found to be an intergrade of *bicarinatus* x *anonymorphus*. Similarly, a specimen catalogued as *irregularis* in the Museum of Comparative Zoölogy collection, was actually an example of *U. gadori*. I do not know from whence Schmidt's brief description (1921:6) of *irregularis* was drawn, but I suspect that the original description of Fischer was used. Although Boulenger's specimens (1885:216) have not been available, I believe that they are also referable to *bicarinatus* or one of its allies, with the original description furnishing the source material for Boulenger's descriptive notes.

Although the extensive Mexican explorations and collections of Nelson and Goldman, and more recently Taylor and Smith, have failed to bring to light any specimens that can be considered conspecific with *irregularis* as I know it from its original description, I prefer to retain this form in name at least, as valid. I take this action on the basis of Fischer's notes and plates, which if accurate to any degree, picture a very distinct animal and one not to be considered synonymous with any known form. Further, great regions which quite possibly are populated with *Urosauri*, as the Durangian and Zacatecan uplands, are very poorly known today, save that they possess a highly distinctive endemic fauna. It is quite possible that *irregularis* will be found to occupy a niche somewhere in this portion of "der Hochlande von Mexico."

UROSAURUS NIGRICAUDUS Cope

1864 *Uta nigricauda* Cope, Proc. Acad. Nat. Sci. Phila., :176.

Type locality. Cape San Lucas, Baja California.

Cotypes. USNM 5307 (twelve specimens).

Diagnosis. Enlarged dorsals in seven to ten rows, commencing about equal to the insertions of the fore-limbs, and extending posteriorly to the sacrum; median rows of dorsals largest, and progressively diminish-

ing in size as they extend laterally; enlarged dorsals prominently keeled, imbricate, rounded posteriorly; seventeen to twenty-four of the largest dorsals equal to the length of head from tip of snout to posterior border of the interparietal; dorsolateral and lateral folds usually present, nearly always crested with enlarged, spinose scales; usually several lateral clusters of enlarged tubercles; frontal usually entire, sometimes transversely divided; enlarged femorals and tibials larger than any of the dorsals; ventrals mucronate on the gular fold, pectoral, and lateral areas, but rounded elsewhere. Coloration (alcoholic) of male topotype: dorsum of body, limbs, head and tail ranging from grayish to dark brown; limbs and tail ringed with narrow bands of dark brown to black; head finely lined with dark brown; body with nine alternating short bars which extend from the dorsolateral fold to about the median line of the back; dorsal bars about two or three scales wide, and of a dark brown color, edged with pale blue posteriorly; labial regions flecked with gray, as is also the gular region save for a light central area which is a pale tan; pectoral region flecked rather heavily with gray, as are also the undersides of the limbs and tail; abdomen with two elongate sky blue patches which are partially fused medially; pre-anal region with a blue wash; abdominal and lateral areas flecked with numerous individual scales which are a paler blue than the remainder of the body. Measurements of fifty specimens, both sexes: head length, 10.35 mm; head width, 7.75 mm; snout to vent, 42.0 mm; hind leg, 28.0 mm; tail, 66.0 mm.

Distribution. South of Lat. 24°30' on Baja California peninsula; also the islands of Espiritu Santo, Ballena, San José and Magdalena (?).

Remarks. This species seems closely restricted to the southern end of the Californian peninsula, for with the exception of its possible occurrence on the Isla Magdalena (*vide* Van Denburgh, 1922:218), from whence I have not seen any specimens, all available records are closely clustered in the region extending from La Paz to Cape San Lucas. The range of *nigricaudus*, insofar as its insular distribution is concerned, is in the main exclusive of *microscutatus*. However, this latter species has been taken on San José Island by Linsdale (1932:362), and I have similarly reported (*supra*) the occurrence of *nigricaudus* on this island too, based on two specimens in the National Museum (USNM 24413-4). However, San José offers a multitude of ecological niches, as I judge from Nelson's description (1921:92), and it seems entirely possible that both forms can exist there without undue competition. At any rate, the *nigricaudus* from this island do not differ in any way from peninsular examples. I have not seen any *nigricaudus* from Mag-

dalena Island, although I have examined *microscutatus* from this locality. Here again it seems quite probable for both species to occur, in view of the two suitable localities which are to be found on the island, and again, both of these well separated (Nelson, 1921:89). Linsdale (1932:361) mentions the occurrence of *nigricaudus* in a variety of situations, notably all vertical, with no specimens having been found on the ground.

UROSAURUS MICROSCUTATUS Van Denburgh

1894 *Uta microscutata* Van Denburgh, Proc. Calif. Acad. Sci., 2 (4), 298.

1900 *Uta parviscutata* Cope, Rept. U. S. Nat. Mus. 1898:324, fig. 45.

Type locality. San Pedro Martir Mountains, Baja California.

Type. Stanford University Museum no. 1221, male.

Diagnosis. A fairly small *Urosaurus*, characterized by the diminutive size of the enlarged dorsal scales; enlarged dorsals extending from the shoulders to the sacrum, in about ten rows; dorsals keeled, rounded posteriorly, pavemented or semi-imbricate, about thirty-two to thirty-six in the length of the head from snout to posterior border of interparietal; dorsolateral and lateral dermal folds and tubercular clusters present; otherwise similar to *nigricaudus* in structure and dorsal coloration; ventral coloration usually a uniform deep blue over the entire gular and abdominal areas, except for the pectoral region, which is grayish, and maculated with darker gray or black; central portion of gular surfaces usually most intense blue; venters of limbs and tail blue-gray to brown; ventrolateral and lateral regions often with flecking of light blue which is usually restricted to a single scale; abdominal blue patches in males usually fused for their entire length. Measurements of fifty adults, both sexes: head length, 10.45 mm; head width, 8.05 mm; snout to vent, 39.75 mm; hind leg, 28.2 mm; tail 72.45 mm.

Distribution. Borego Palm Cañon, San Diego County, California, south through the San Pedro Martir district and Lower Sonoran zone of Baja California to Medano Amarillo at Lat. 24° (*vide* Linsdale, 1932:362); also the islands of San Marcos, Coronado, Carmen, Danzante, San José, San Francisco and Santa Magdalena.

Remarks. This and the preceding species are certainly closely allied, with *microscutatus* apparently a derivative of the older *nigricaudus*. There is little to separate them, in a qualitative sense, unless it be the ventral coloration. In other respects, they are chiefly distinguishable by the nature of certain quantitative features. Possibly the simplest



Fig. 11. Distribution of *Urosaurus microscutatus* and *Urosaurus nigricaudus* in Baja California and the United States.

feature to verify in *microscutatus* is the size and number of the enlarged dorsal series. However, these increase in size, and decrease correspondingly in number, as the species progresses in a southerly direction. I believe that intergradation between *microscutatus* and *nigricaudus* will be shown when a more complete series of specimens of both forms, from the region between Comondú and Baie Magdalena, is available. In three specimens of *microscutatus* from Comondú (USNM 65822-4), there is a definite tendency toward *nigricaudus*; thus, the dorsals are larger than in more northerly *microscutatus*, and the heavy blue wash so typical of this species is replaced by two abdominal patches and a gular pigmentation quite akin to that of *nigricaudus*. While these specimens seem to definitely indicate an incipient, if not actual intergradation, I hesitate to accord the species involved the trinomials on such slim evidence.

Despite their close alliance and the certain derivation of one from the other, *microscutatus* and *nigricaudus* are apparently everywhere distinct geographically and ecologically (unless in the Comondú-Baie Magdalena region previously discussed). Linsdale (*loc. cit.*) points out that while *microscutatus* is often found on the ground, *nigricaudus* is always restricted to the vertical habitat on trees, rocks, and fences. Even so, available specimens indicate that there is no overlap of ranges, unless it is in the hypothetical intergrading area. Where the two species occur together, as on San José and Magdalena islands, they are even then distinct ecologically. Both of these islands are only recently isolated from the mainland of the peninsula, and represent two or more leveled mountains, with intervening areas filled by the deposition of sand by the sea. As such, they present diverse ecological niches which are filled by the two species in question, each to the exclusion of the other.

Mensural data indicate that while *microscutatus* is a somewhat smaller form than *nigricaudus*, it possesses a proportionately longer and wider head, a longer hind leg and a longer tail. Klauber (1939:89) says that the blue gular color usually present in males of *microscutatus* in the southerly portions of the range, is replaced by orange, with a yellow central spot, in the northern regions. A few specimens from Jacumba, San Diego County, California (USNM 75338) have the same blue coloration of the gular region that is to be seen elsewhere in the range of *microscutatus*. The only region where the blue gular color is replaced by any other hue, as far as I know, is in the extreme southern end of the range, in the vicinity of Comondú, where the few available specimens display the orange (tan in preservative) throat and gular

region characteristic of *nigricaudus*. If indeed *microscutatus* does exhibit this color aberration in the northern part of its range, it would be interesting to determine if it undergoes intergradation with any other species in the genus. Specimens from the north are still too few to determine this.

Summary of the *nigricaudus* Complex

The *nigricaudus* complex presents a small, compact group of four more or less closely allied forms, of somewhat uncertain origins. They compose a homogeneous group by reason of the usually entire frontal, and uniform band of enlarged dorsals which are not divided into parallel series by the presence of vertebral, smaller scales; there is also a certain uniformity of color and pattern, and a relative uniformity of size.

While the uncertainty surrounding the status of *U. irregularis* has been previously discussed, it may be said that this form (judging solely from the original description and figures) seems to be the most primitive one of the complex, and apparently the only one allied to any species outside the complex. The derivation of *microscutatus* from *nigricaudus* has been indicated elsewhere; similarly, the very close relationship between *nigricaudus* and *gadovi* has been discussed. I presume that *nigricaudus* is directly derived from *gadovi* in view of the greater age of the Jalisco-Michoacán region which this latter species inhabits, and the known history of the formation of the Californian peninsula. Retrogressive reasoning, therefore, would show that the complex arose somewhere near or on the west coast of Mexico, possibly in the Jalisco-Michoacán region, and spread westward. Continuing in this vein, it follows that some sort of relationship, perhaps not so tenuous, exists between *gadovi* and the much-discussed *irregularis*. By the process of elimination, it has been shown that *irregularis* would hypothetically inhabit some portion of the Mexican highlands, or plateau, a region of comparatively great age. Since this region is older than any other known which supports any of the members of the complex; and further, since the derivative nature of *microscutatus* and *nigricaudus* is known, as is also the relatively recent character of their habitat, it would follow, I assume, that *irregularis* is the primitive member of the *nigricaudus* complex. I have pointed out that in the *ornatus* complex, there is a distinct trend toward an increase in size of the vertebrals, which ultimately has resulted in the uniform size of the enlarged dorsals in *graciosus*. It does not seem far-fetched at all

to suppose that a similar condition has produced the *nigricaudus* group. Occasional specimens of *U. b. bicarinatus* have the parallel rows of enlarged dorsals interrupted by an inordinate increase in size of a few of the vertebrae. A successive development such as this would result in a form which we might today identify as *U. irregularis*. From *irregularis* to the highly evolved *microscutatus* we can establish a fairly certain line.

The trend in the line *irregularis-gadori-nigricaudus-microscutatus* is from a large, strongly imbricate, heavily keeled, mucronate enlarged dorsal scale, to a much smaller one, which is only partly keeled, occasionally pavemented, and distinctly rounded posteriorly. Similarly, in the same line, the ventrals change from sharply mucronate, spinose, keeled scales, to rounded, smooth ones. There is also a gradual increase in the number of rows of enlarged dorsals; thus in *irregularis* the number is two or three, in *gadori* four to seven, in *nigricaudus* seven to ten, and in *microscutatus*, at least ten, and occasionally twelve to fourteen. The heavily crested dorsolateral folds which form actual ridges, progressively diminish, from *irregularis* to *microscutatus*, until in this latter form, the folds are only topped with small clusters of slightly enlarged tubercles. In addition to these premises, from *irregularis* to *microscutatus* there is a tendency to produce a smaller body and a longer tail.

UROSAURUS AURICULATUS Cope

1871 *Uta auriculata* Cope, Proc. Boston Soc. Nat. Hist., 14: 303.

Type locality. Socorro Island, Revillagigedo Archipelago.

Type. USNM 7027, female.

Diagnosis. A fairly large member of the genus, unique in the possession of smooth enlarged femorals; two rows of vertebrae, which are rather weakly carinate, imbricate, and regularly arranged, bordered on either side by a single series of enlarged dorsals, which are relatively flat and weakly keeled, and not very regularly dispersed; frontal divided or entire; external to the primary series of enlarged dorsals there are often one or two additional series of irregularly arranged scales which do not continue in even rows, and are of variable size; along the dorsolateral fold a variable series of enlarged scales, some tubercular and others flat and mucronate, these in irregular groups; post-femoral dermal pocket variable; coloration ranging from grayish to bright blue, with six to eight short cross-bars along the dorsum in alternating position, which are light-edged (usually with pale blue) on

their posterior borders; light lateral and ventral fleckings of pale blue, restricted to single scales, or small groups of tubercular scales; males with extensive deep blue abdominal patches, females with an uneven light blue abdominal wash. Measurements of seven adults, both sexes: head length, 16.5 mm; head width, 12.45 mm; snout to vent, 65.5 mm; hind leg, 44.0 mm.

Distribution. Restricted to the type locality.

Remarks. As indicated under the discussion of *U. clarionensis* as well as the remarks dealing with the *ornatus* complex as a whole, *auriculatus* is well separated from the nearby *clarionensis* of Clarion Island, and rather than exhibiting any morphological similarity with this latter species, the alliance is with the *bicarinatus* group.

This species is one of the largest in the genus, and appears to have adapted itself to its insular habitat very well, if size and the number of specimens inhabiting the island (*vide* Cope, *loc. cit.*; Van Denburgh, 1922:199) may be considered sound criteria on which to base such a supposition. The smooth enlarged femorals are unique in the genus, and of uncertain phyletic importance and derivation. As a whole, the species is not a rugose one, and seems to have lost much of the bristling appearance common to other Urosauri; it is likely that a chance mutation, or series of mutations, has caused the appearance of these peculiar characters, and have become prominently evidenced by the enforced inbreeding of the island population.

UROSAURUS BICARINATUS BICARINATUS Duméril

- 1856 *Phymatolepis bi-carinatus* Duméril, Arch. Mus. Hist. Nat. Paris, **8**: 549, pl. 23, figs. 2, 2a, 2b.
 1864 *Uta bicarinata* Cope, Proc. Acad. Nat. Sci. Phila., **16**: 177; Boulenger, Cat. Liz. Brit. Mus., 1885, 2:215; Schmidt, Amer. Mus. Nov., 1921, **22**: 6; Smith, Univ. Kan. Sci. Bull., 1935, **12** (7): 169.
 1941 *Uta bi-carinata bi-carinata* Mittleman, Jour. Wash. Acad. Sci., **31**: 70.

Type locality. "Mexico".

Type. Not designated; if in existence, probably in the Muséum d'Histoire Naturelle de Paris.

Diagnosis. Two or three vertebral series of enlarged scales extending in a continuous or often broken line from the nape to the basal portion of the tail; on either side of the vertebrae is a single series of greatly enlarged, strongly carinate, imbricate scales, which are often irregularly dispersed, and frequently interrupted by the intrusion of small heterogeneous scales, or the aberrantly large size of a vertebral

scale; largest of the dorsals subequal to the enlarged femorals and tibials, which are strongly carinate; external to the enlarged dorsal series, a series of enlarged scales which almost equal the primary dorsals in size and rugosity; these latter scales sometimes in contact with the dorsals, but more often separated from them by the varying width of two to four of the small granular scales of the dorsum; these enlarged scales bordering the primary dorsals are also irregular in size and disposition, but usually occur in a line which commences anterior to the primary dorsals; two or three series of thoracic tubercles; a prominent series of enlarged tubercles, and mucronate and spinose flatter scales on the dorsolateral line; ventral to the dorsolateral series of enlarged scales, are four other series of enlarged tubercles, the lowest of which is in contact with the ventrals; ventrals mucronate, and posteriorly and laterally, they become spinose, as well as keeled; gular scales granular and paved, except along the gular fold, where they are elongated, mucronate, and heavily imbricate; frontal most often entire; postfemoral dermal pocket absent, but occasionally represented by a minor whorl of underdeveloped scales. Coloration (alcoholic) of male: dorsum of head, body and tail grayish, with four to six dark cross-bars, which are occasionally obliterated by a heavy deposition of dark melanins throughout the skin; the cross-bars are usually broken medially, and often alternate; dorsum of body and limbs often flecked with varying shades of gray or brown, lateral areas similar, but usually tinted with a bluish wash; venter of limbs, and interhumeral and interfemoral areas of varying shades of gray, but most often heavily flecked with darker gray or brown; ventral basal portion of tail gray to brown, flecked with darker; long, deep blue abdominal patches, which may or may not be overlaid with a heavy stippling of brown or dark gray; except for a median light area occasionally, the entire gular surface including the infralabials, is heavily mottled with black, gray, or brown. Smith (1935:170), reporting on freshly collected specimens from Morelos and Guerrero, says "the entire gular region is orange, coarsely reticulated or diagonally barred with black except in a large, round median area just anterior to the gular fold." Measurements of fifty adults, both sexes: head length 12.5 mm; head width, 10.6 mm; snout to vent, 52.5 mm; hind leg, 29.6 mm.

Distribution. Michoacán, Morelos, Puebla, and Guerrero west of Acapulco.

Remarks. Because Duméril designated only "Mexico" as the type locality for *bicarinatus*, and this only by inference, subsequent authors

have reported many specimens ostensibly of this species, from widely divergent points in Mexico (see Smith, 1935:171). Actually, as Schmidt (1921) pointed out, at least two of the populations of what had previously been accepted as *bicarinatus*, were referable to separate subspecies. It is therefore obvious that the majority of previously published records for *bicarinatus* are actually referable not only to this form, but to several others, which do not occur within the range of *bicarinatus*. Schmidt (*op. cit.*), Smith (*loc. cit.*), and I, have reviewed the populations of *bicarinatus*, and find, insofar as available material indicates, that *bicarinatus* is distributed as given above.

I have pointed out (1940:34) that specimens from the southern periphery of the range of *bicarinatus*, notably in the area between Acapulco and Tierra Colorada, Guerrero, differ from the more northerly population of this subspecies. Ultimately, in extreme southeastern Guerrero, and continuing eastward through most of Oaxaca to southwestern Chiapas, these lizards become clearly recognizable as a separate biological entity, and have been so designated (Mittleman, *loc. cit.*).

Smith (1935:171) reports "The species is apparently entirely arboreal. Some specimens were found on some of the large species of cactus of the genus *Opuntia*. Their coloration is extremely protective; they were frequently discovered only by striking likely-looking trees with a shovel or heavy stick. Usually two or more occurred together on the same tree or cactus."

UROSAURUS BICARINATUS ANONYMORPHUS Mittleman

1940 *Uta anonymorpha* Mittleman, *Herpetologica* 2, (2): 34, pl. 3, fig. 2.

1941 *Uta bi-carinata anonymorpha* Mittleman, *Jour. Wash. Acad. Sci.*, 31: 71.

Type locality. Tehuantepec, Oaxaca, Mexico.

Type. USNM 46988, male.

Diagnosis. Enlarged vertebrae and the single series of enlarged dorsals commencing on the shoulders only slightly cranial of a line joining the anterior points of insertion of the fore-limbs; enlarged dorsals in a continuous series, or only barely encroached upon by a few of the small granules of the back; enlarged dorsals regularly arranged, forming parallel rows on opposite sides of the vertebrae, and not too strongly carinated; external to the enlarged dorsals is a sparse series of large scales, which are a trifle larger than the vertebrae but never approach the enlarged dorsals in size; this series of scales never in contact with the enlarged dorsals, but in contact at several points with the rather poorly developed dorsolateral series of tubercles and mucronate

scales, through the medium of small, elongate clusters of slightly enlarged, granular scales; thoracic tubercles not well developed, and not prominent; dorsolateral and lateral tubercles often not enlarged, and similarly often not in clusters, instead there is usually a single enlarged, tubercular scale, surrounded by a few mucronate, spinose, flat scales; ventrals mucronate and spinose, especially posteriorly; laterally, the ventrals become carinate and quite distinctly paved; gular scales granular, flat, and paved, except in the region of the fold, where they are elongate, spinose, lightly carinate, and imbricate; general appearance not very rugose; frontal always entire; postfemoral dermal pocket regularly lacking. Coloration (alcoholic) of male holotype: quite similar to that of *bicarinatus*, save that the ventral blue, or blue-black patches are very abbreviated and restricted to the pectoral area. Chin usually not so heavily maculated as in *bicarinatus*; occasional specimens are uniformly suffused with a deep blue-gray which completely obliterates any traces of the dorsal pattern. Measurements of holotype: head length, 11.5 mm; head width, 9.0 mm; snout to vent, 50.0 mm; hind leg, 27 mm.

Distribution. Guerrero, east of Tierra Colorada; Oaxaca, except the north-central portion; western Chiapas (Tonolá).

Remarks. At the time of original description of *anonymorphus* I postulated a probable subspecific relationship between this form and *bicarinatus*. Somewhat later (1941:72) I was able to report that such a relationship actually existed, as borne out by a series of 98 specimens taken by Dr. Hobart M. Smith from eastern Guerrero to Chiapas, as well as others from Morelos, western Guerrero, and elsewhere in the range of *bicarinatus*. Dr. Smith's fine series of specimens show that *bicarinatus* apparently terminates in the vicinity of Acapulco, Guerrero, and that in the relatively short distance from this city to Tierra Colorada, Guerrero, the transition from this form to *anonymorphus* takes place, with this latter subspecies becoming clearly recognizable from the vicinity of Tierra Colorada, and continuing southward and eastward. The extension of the range of *anonymorphus* to include Chiapas is on the basis of two specimens taken by Dr. Smith at Tonolá. While these two individuals possess certain aberrations which to a degree remove them from *anonymorphus*, they resemble this form most closely, and are considered to be such, at least until further specimens will have been taken from more easterly points in Chiapas.

Generally speaking, *anonymorphus* is quite easily separated from *bicarinatus*. In males, the abbreviated blue abdominal patches are quite distinctive in *anonymorphus*; while the ventral coloration tends

to take on the appearance of an evenly diffused wash in *bicarinatus* males. In specimens of either sex, *anonymorphus* can be identified at once by its much less rugose appearance, and the definitely weaker carination of the enlarged dorsals. More often too, *anonymorphus* will possess an evenly mottled chin, whereas *bicarinatus* has a tendency to possess a light median area, as has been noted by Smith (1935:170). The holotype and the paratypes on which *anonymorphus* is based, agree very well with the series of 98 specimens taken by Smith.

UROSAURUS BICARINATUS NELSONI Schmidt

1921 *Uta nelsoni* Schmidt, Amer. Mus. Nov., **22**: 4.

1941 *Uta bi-carinata nelsoni* Mittleman, Jour. Wash. Acad. Sci., **31**: 72.

Type locality. Cuicatlam (=Cuicatlán), Oaxaca, Mexico.

Type. USNM 46836, male.

Diagnosis. Most closely allied to *bicarinatus* and *anonymorphus*, from which races it differs only as follows: ventrals not mucronate; dorsolateral and lateral series of tubercles poorly developed; head narrower proportionately than in *bicarinatus*, and proportionately broader than in *anonymorphus*; enlarged dorsals smaller. Measurements of type: head length, 13.5 mm; head width, 10.5 mm; snout to vent, 58.0 mm; hind leg, 33.0 mm.

Distribution. Restricted to the type locality.

Remarks. I am familiar with *nelsoni* only through the type specimen, which is distinct enough from other subspecies of *bicarinatus*, as given above. I hesitate to postulate further on it, since it is so little known. My reasons for considering *nelsoni* a subspecies of *bicarinatus* have been previously (1941:73) given as follows: "*U. b. nelsoni* is designated as a subspecies of *bi-carinata* for the following reasons: The marked similarity in structure to the typical form and *anonymorpha*; the continuity and contiguity of its distribution with the *bi-carinata*—*anonymorpha* stock, the ranges of all three being juxtaposed; and the possibility that *nelsoni* represents an intermediate population in position between the *bi-carinata*—*anonymorpha* stock, and some form, as yet undescribed, from extreme northwestern Oaxaca and possibly southern Veracruz." Since the writing of the above passage, neither additional specimens nor information have come to hand, so that further investigation of this form must await additional, comparative material.

UROSAURUS BICARINATUS TUBERCULATUS Schmidt

- 1921 *Uta tuberculata* Schmidt, Amer. Mus. Nov., **22**: 4; Smith, Univ. Kan. Sci. Bull., 1935, **12** (7): 171.
- 1941 *Uta bi-carinata tuberculata* Mittleman, Jour. Wash. Acad. Sci., **31**: 73.

Type locality. Colima, State of Colima, Mexico.

Type. AMNH 13737, male.

Diagnosis. Most closely related to *bicarinatus*, from which it differs as follows: enlarged dorsals larger, more regularly arranged, and equal to or greater than the enlarged femorals and tibials; external to the enlarged dorsals, but in contact with them or separated by only one or two granules, is a series of slightly enlarged scales which are visibly keeled, but neither so large nor so prominent as the primary dorsals; dorsolateral and lateral tubercles and enlarged spinose scales very regularly arranged, but not so prominent as in *bicarinatus*; lowest series of tubercles in contact with the ventrals which are not sharply differentiated from the granular scales of the sides; ventrals rounded, occasionally submucronate; slightly keeled laterally; gular scales elongate and imbricate, except those immediately adjacent to the infralabials, where they are granular and paved; frontal variable, usually divided; postfemoral dermal pocket variable, occasionally present; coloration similar to *bicarinatus*. Measurements of type: head length, 12.0 mm; head width, 9.0 mm; snout to vent, 45.0 mm; hind leg, 27.0 mm.

Distribution. Discontinuous, recorded from Colima and Jalisco (Schmidt, *loc. cit.*); Presidio de Mazatlán, Sinaloa (Smith, 1935:171) 20 miles southeast of Alamos, Sonora (Mittleman, 1941:73).

Remarks. "Other than some slight variation in color and pattern, the specimens I have seen agree rather well with the type, differing only in a few minor points.

"Because of a dearth of *Utas* from southern Sonora to central Jalisco, the distribution of *tuberculata* is imperfectly known. First known from Jalisco and Colima, the type series remained unique until Smith (*loc. cit.*) reported a specimen taken by him just south of Presidio de Mazatlán, Sinaloa, which extended the range northward for about two hundred miles. In the course of an examination of Mexican *Utas* in the collection of the Museum of Comparative Zoölogy I came upon two specimens, MCZ nos. 37856-7, collected near Guirocaba, 20 miles southeast of Alamos, Sonora. These two specimens are quite typical of the subspecies, and on the basis of their locality, the range

of *tuberculata* is extended northward again for another two hundred and eighty miles. Dr. Smith tells me in a letter that this closely corresponds to the distributional pattern of *Sceloporus nelsoni*.

"*U. b. tuberculata* is obviously a member of the neotropical *bicarinata* stock; just what its relationships with the nearctic *lateralis* might be must await the discovery of further specimens from Sinaloa, southern Sonora, and northern Jalisco." (Mittleman, 1941:73-74).

UROSAURUS UNICUS Mittleman

1879 *Uta bicarinata* Cope, Proc. Amer. Phil. Soc., **18**: 261; Bull. U. S. Nat. Mus., 1887, **32**: 35; Amer. Nat., 1896, **30**: 1020; Rept. U. S. Nat. Mus. 1898 (1900):320.

1941 *Uta unica* Mittleman, Jour. Wash. Acad. Sci., **31** (2): 74, figs. 1c, 2, 3.

Type locality. (?) Batopilas, Chihuahua, Mexico.

Type. USNM 14248, female.

Diagnosis. "Cephalic scales comparatively smooth; frontal entire, separated behind from the interparietal by a pair of frontoparietals; rostral much wider than high; supralabials 5-5, the fourth and fifth subocular in position; infralabials 7-7; auricular opening anteriorly denticulated by several enlarged, granular scales; a few scattered enlarged scales on the nape and shoulders, extending caudad from a point just posterior of a line joining the anterior insertions of the fore limbs, along the vertebral line onto the base of the tail for a distance subequal to the length of the femur, is a series of enlarged scales, bordered on each side by a single series of much larger scales, which are, however, inferior in size to the enlarged scales of the femur, but larger than the enlarged tibial scales; enlarged dorsal scales only weakly carinated, and prominently pavementated; external to the enlarged scales and in contact with them, or more often separated by the width of the vertebral series, is another series of enlarged scales, spaced about two scale lengths apart; these latter equal to or slightly smaller than the enlarged scales bordering the vertebral series; the outer enlarged scales often surrounded by minutely enlarged tubercular scales; on the dorsolateral, lateral, and ventrolateral areas are evenly dispersed four longitudinal series of small clusters of slightly enlarged, somewhat convex scales, which are not at all rugose; the lowermost of these rows of clusters barely in contact with the ventrals; ventral scales imbricate and mucronate anteriorly, but medially, laterally, and

posteriorly, they become rounded and quite paved, again becoming spinose and imbricate as they approach the anal region; ventrals abruptly diminishing in size to meet the lateral scales; gular scales paved and rounded anteriorly, but mucronate and imbricate posteriorly, and noticeably increasing in this tendency, until in the region of the gular fold the scales are longer than wide and distinctly spinose; gular fold extending laterally and dorsally around the anterior edge of the insertions of the fore limbs, and met by a heavy postauricular fold; caudal scales large, prominently keeled, spinose, and at least basally, in irregular whorls of three verticils, of which the first is always prominently largest; postfemoral dermal pocket absent. Coloration of holotype (alcoholic): Dorsum of head and body greenish gray, the head finely reticulated with light brown, and the body with two light brown bands which are narrow on the vertebral line and widen as they progress laterally; dorsum of the body irregularly flecked and barred with dark brown; axillary, inguinal, lateral, prehumeral, posthumeral, and postanal regions washed with dark brown; an irregular dark brown pectoral blotch; gular area and the remainder of body and tail venter a very pale greenish gray; limbs narrowly barred with light brown. Cope (*loc. cit.*) [1900:322] describes the specimen which was then fresh, as having "limbs and tail shaded with reddish brown," and says further that the "inferior regions tinted yellow lightly stippled with brown; males have the entire abdominal region bluish gray." Measurements of holotype: Snout to posterior border of ear, 11.5 mm; head width, 9.0 mm; snout to vent, 50.0 mm; hind leg (insertion to tip of 4th toe, exclusive of nail), 26.5 mm; tail 52.0 mm." (Mittleman, *Loc. cit.*)

Distribution. At present known only from extreme southwestern Chihuahua.

Remarks. This very unique species is quite different from other known *Urosaurus*, and as far as I am able to determine, it represents a dwarf offshoot of a probable *pre-tuberculatus* stock. Its distinctness indicates a considerable age, and long separation from other members of the genus.

When I recently described the species on the basis of the sole specimen known, I presented all of the available data on its provenance, simply that it was collected in Chihuahua, Mexico, by Edward Wilkinson. Since then, certain data have accumulated, to some degree circumstantial, which appear to indicate that the type locality of *unicus* is properly Batopilas, Chihuahua. Because several other genera and species of reptiles were probably collected at the same locality and

time by Wilkinson, and because data on these forms have been similarly lacking, I present a brief summary of what is known concerning these animals, as well as *unicus*.

The first published reference to a herpetological collection made by Edward Wilkinson, is that of Cope's (1879:261). Here Cope lists eight species of lizards, and seven of snakes, all taken at Batopilas, Chihuahua. Included in this list is "*Uta bicarinata*" with which form Cope later (1900:320) confused the specimen now designated as the type of *U. unicus*. Somewhat later, Cope again made reference to the Batopilas collections of Wilkinson, and said (1887:35), "*Uta bicarinata* Duméril... Batopilas, Chihuahua, Wilkinson. City of Chihuahua, Wilkinson..." Still another reference to the "*bicarinata*" and the Batopilas collection was made (1896:1020), when Cope mentioned "A small collection made by Wilkinson in southern Chihuahua at Batopilas has the character of the Chihuahuan fauna, with the following species not otherwise found in it . . . *Uta bicarinata* Dum." Finally, Cope says (1900:322) of "*Uta bicarinata*", "This species occurs throughout Mexico, as far north as the City of Chihuahua, where it was obtained by Mr. Edward Wilkinson." However, on the page preceding, the figure of Cope's "*bicarinata*" (fig. 43), based on USNM 14248, now the type of *unicus*, bears only the legend "Chihuahua, Mexico."

I think the preceding quotations and references show that there can be little doubt that the origin of *unicus* is Batopilas. Cope's last reference to "*bicarinata*" from the City of Chihuahua is certainly attributable to one of his careless oversights. Either he mistakenly considered a specimen of another *Urosaurus* from the City of Chihuahua to be one of his "*bicarinata*", which does not seem likely, or else he confused the locality data of his specimen, which was probably shipped to the National Museum from this city, although collected at Batopilas. Furthermore, in Cope's original paper on Wilkinson's Batopilas collections (1879:262) appears the description of a new species, *Procinura aemula*, which Cope later refers to as *Scolecophis aemulus* (1900:1109), and which, significantly enough, he says was collected at Batopilas. Since the *Procinura* or *Scolecophis* was originally listed with the "*Uta bicarinata*" as having been taken at Batopilas, and the reference again given at a later date, Cope's other references to "*bicarinata*" from as far north as the City of Chihuahua are plainly explicable as stated above. In view of extensive collections throughout the greater part of Mexico, which indicate that *bicarinatus* does not range anywhere near the City of Chihuahua, or even in the state itself, and further, since Chihuahua is known to possess several

forms of *Urosaurus*, except in the southwestern corner from whence no specimens have been available (other than *unicus* if it was actually taken there), in the light of the evidence adduced, I consider Batopilas as the type locality of *unicus*.

As a further matter of record, it may be stated that through some sort of agreement between Cope and Wilkinson, the collections of the latter went to Cope through the National Museum, probably to avoid payment of duties. Also, Wilkinson made at least two other collections, in the vicinity of the City of Chihuahua, for *Trimorphodon wilkinsonii* was taken there, and described by Cope in 1885, while a single bird egg is catalogued in the National Museum as having been taken in the Sierra Eulalia, near the City of Chihuahua, Wilkinson, collector, 1886. Naturally, there is the possibility of Wilkinson's having spent several years collecting throughout Chihuahua, and sent several collections from different points within the state. Cope apparently kept all the Wilkinson specimens in his personal collection for some time, and then donated them to the National Museum, and catalogued them all at once. This is corroborated by the fact that all Wilkinson specimens are catalogued in the National Museum under the numbers 14222-14310. Since the "*Uta bicarinata*" and other specimens reported by Cope in 1879, as well as the type of *Trimorphodon wilkinsonii* which was collected several years later are all catalogued together, it bears out the contention that the numerous specimens were deposited in the National Museum simultaneously. Incidentally, Cope, by previous arrangement with Wilkinson apparently, sent him twenty of the specimens after they had been catalogued (Nos. 14257, two specimens; 14263-4; 14270; 14274; 14276; 14281-2; 14296, six specimens; 14303, five specimens). For none of these is there any information as to provenance or identity. They have never been located, although there is some reason to believe that they may be housed with some of Wilkinson's personal effects (if they are indeed still in existence) in the Mansfield (Ohio) Memorial Museum.

Summary of the *bicarinatus* Complex

The several species and subspecies which are here included in the *bicarinatus* complex have common bonds by reason of the frontal which is nearly always entire, the usual lack (or only rudimentary development) of the postfemoral dermal pocket, and chiefly, the single principal row of enlarged dorsals on either side of the vertebrae.

With the exception of *unicus*, whose phyletic relationships and derivation can only be hazarded hypothetically, the constituent forms of the complex are closely united, and differ only in degree, rather than kind. They occur, more or less continuously, from southern Sonora along western Mexico to western Chiapas.

The neotropical *bicarinatus* complex appears to have been directly derived from *schottii*, or a pre-*schottii* form, at about the time of the early Miocene, and must have then invaded the newly emerged land lying to the south of what is now Sinaloa, for prior to this era, most of west-coast Mexico from northern Sinaloa to Jalisco, and south to the Yucatan Peninsula, was inundated. The divergence of the complex has been hampered only by the high Sierra Madre del Occidental to the east, and the Pacific Ocean on the west. The sole member of the complex which occurs anywhere other than on the Mexican mainland (*auriculatus*, of Socorro Island), is an ancient relict form, whose appearance has been most fortuitous (see discussion of *clarionensis* and the *ornatus* complex).

With the exception of *unicus*, which for the present can only be dismissed as a relict end-form, the *bicarinatus* group has resulted through direct orthogenetic activity, and the constant drive into previously unoccupied territory, accompanied by genic changes within successive end populations. There is little apparent difference in the ecology of the several forms, so that it can only be assumed that constant differences and the comparative lack of wide intergradation are due to physiological barriers, rather than ecological and/or geographic ones.

The complex has formed in the line *auriculatus-tuberculatus-unicus-bicarinatus-nelsoni* and *anonymorphus*, the last two possibly having occurred simultaneously. In this line, we find that the postfemoral dermal pocket is variable in *auriculatus* and *tuberculatus*, absent in *unicus*, nearly always absent or at best rudimentary in *bicarinatus*, and always lacking in *nelsoni* and *anonymorphus*. Similarly, from north to south, the trend is from a fairly rounded, smooth ventral, to a mucronate or spinose, and carinated one. In the progression from north to south, the frontal assumes a more stable character, so that ultimately in *nelsoni* and *anonymorphus* only an occasional aberrant possesses a divided frontal.

It seems entirely within reason to expect the occurrence of still another *Urosaurus* in eastern Chiapas. I have mentioned that specimens of *anonymorphus* from Tonolá are aberrant. In addition, it may be pointed out that the general region including eastern Chiapas was separated from the Tehuantepecan area by a post-Miocene immersion,

and did not emerge and become continuous again until the Pliocene, thus affording ample time for the differentiation of another race, especially if an endemic population remained. A similar case in point has been found in *Cnemidophorus* (Burt, 1931:73).

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